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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES.

Encouragement, Freightage, and Capital.

APART from the review of the results of the past half-year's operations under the conditions of unparalleled complexity by which the trading machinery of the country was thrown out of gear, the ascendant note in the speech of the Governor of the Gas Light and Coke Company (Sir Corbet Woodall, D.Sc.), at the meeting of the proprietors last Friday, was one of sound confidence as to the future. Under the most genial of circumstances, the responsibilities and obligations associated with a manufacturing, distributing, and trading concern of such magnitude as this one, are heavy and continuous; but the intricacies occasioned the last few months by the war must, through the very vastness of the concern, have brought upon the Governor, his colleagues, and the officers of the Company an intensity of anxiety far in excess of that which has been experienced by every other Board of Gas Directors and Gas Committee in the kingdom. This being so, the hopeful words of the Governor, when surveying the present conditions, and gauging from them the prospects as far as the density of the future permits, will, as Mr. R. J. Neville-Neville, M.P., said at the meeting, be an encouragement to gas administrators all over the country. There seems to be little question now, as things have shaped, that, if transport and freightages do not continue their detrimental weight upon the situation, the worst effects of the war—subject to contingencies of really disastrous order not befalling—have been felt so far as the trading of gas undertakings is concerned. No one can, of course, speak with certainty; but the omens are good.

What applies to the Gas Light and Coke Company applies, with the necessary differences imposed by local circumstances, to other gas undertakings. In the first place, it is more excuse than sober reality to say there is a general shortage of coal at the pits. This is satisfactory, seeing that we are emerging from winter. The imports of gas oil, too, have been, during the latter months of the past year and the opening month of this, of a generous order. At the pithead, there ought not to be any accession of price for coal; we rather think Sir Corbet is indulging the hope that there may be for contract purposes some reduction of price, which will help to alleviate the greater cost of transport. Transport, there is no doubt, is the salient difficulty which now presents itself; and this will anyway make the cost of raw material for gas manufacture get dearer. There is also the reduced gas consumption, especially where regulation has curbed the amount of street and shop illumination, and closed at an earlier hour the doors of establishments where intoxicants are sold. But as against this there is a fairly heavy demand for gas in connection with military camps, hospitals, clubs, and factories turning out war material, food stuffs, and other requisites. The general industrial use of gas is also a healthy and growing branch. So that, while the enforced reduction of gas consumption is too substantial to be counterbalanced, some of its weight is removed by the steady extension of the outlets for temporary and permanent business. As to residual products, coke yards have been practically denuded of stocks, largely owing to the strain of the war on the transport of coal; and production will shortly be at a diminishing rate. Tar will probably be doing better soon, owing to the exhaustion in the country of the stocks of foreign-made chemicals and other products of tar, as well as the demand which is already here, and will extend, for other derivatives of tar—for example, those which serve as the raw material for the production of dyes. Pitch, of course, is an ugly feature; and, as the Governor, by way of illustration, pointed out at Friday's meeting, while such a freightage prevails as 30s. (an increase from 8s. 6d.) for pitch to the South of France for briquette making, there is not much hope for any great improvement there. The closing of Germany's outlets for sulphate of ammonia has put the price of our home production at a more satisfactory figure than ruled a short time since. In these combined circumstances, trading conditions for gas undertakings should, while the war lasts, improve rather than deteriorate. Indeed, the final words of Sir Corbet's speech at the Gas Light Company's meeting could be adopted and applied by many chairmen of gas companies at meetings now being held. "There is nothing," he said, "in the situation to shake our confidence in gas and in "the Company. I say—not as a matter of peroration, but "in sober truth, capable of proof by facts and figures—that "while our difficulties and disappointments are temporary "and accidental, our financial and commercial strength "and stability are permanent, and have been husbanded, "developed, and extended for years past, so that we are "thoroughly well found and equipped for weathering the "storm that assails us, from so many different quarters at "once."

All through, except in one respect, the speech of Sir Corbet was optimistic. The one exception has reference to coal transport and freightages, and the action of the Government in asking what is considered to be the market freightage rate—but which is a market imposition—for the relief ships they have provided from interned German vessels, and which in number and tonnage are quite inadequate to current needs. There was protest against this; there was gravity in the words which warned the Government as to the peril which faces London through the failure of the gas supply and other public services, unless prompt and sufficient measures are taken to put an end to what has become a crisis, real and ominous, in regard to the feeding of London with coal. Strong representations on the subject are about to be made to the Government; and it is hoped that they will heed words which will be those not of panicmongers, but of responsible men in control of the public services of the Metropolis. So far as the Gas Light and Coke Company are concerned, the Board are legislating for the future. The Company have recently had two colliers wrecked; but the Directors have already purchased two, have decided to purchase a third, and have put on order a new ship. These are not the times for half-measures; and the paramount duty recognized by the Board is the maintenance unimpaired of the gas supply.

There was not much discussion at the meeting that was material to the present situation and experiences. Such as it was, it was in generously sympathetic terms with the Board in their immediately past and confronting difficulties. Elegant and concise expression of this sympathy fell from Mr. Arthur M. Paddon, who had also attended obviously prepared gently to admonish the Directors for having reduced the price of gas to the 2s. 6d. at which it stood prior to last Michaelmas, and to ask them to consider the matter of maintaining the present charge of 2s. 8d. while the capital of the Company stands at the figure it now does per million cubic feet of gas sold—that is, at £566. The Governor agrees generally with the policy underlying Mr. Paddon's suggestion; but he does not concur in its application to the Gas Light and Coke Company. Mr. Paddon, it seems, has been considering the matter from too narrow a point of view, so far as this Company is concerned, by merely taking into account the existing relation of capital to sales, without dipping into the history of the concern to see what has actually happened during quite recent years under the Directors' preferred policy. His policy of relief for the Company is a higher price of gas to provide funds for the reduction of the capital; while the policy of the Governor and his colleagues has been, by a lower price, to increase the business done, and by this means to reduce the relation of capital to sales. In this action they have been eminently successful—successful to a degree that could not, in our opinion, have possibly obtained by any other policy in an area of London where the competitive conditions are, it is pretty safe to assert, of an unparalleled order. All we can say is that we hope the Directors will (when a return to

normal conditions allows) continue their policy which has proved so efficacious. That they intend doing so was disclosed by the emphatic, though courteously uttered, words of Sir Corbet that, "as soon as the balance in hand is sufficient, we shall again reduce the price."

When the charge for gas was high—much higher than it has been lately—the capital of the Company was one in relation to business done that was a reproach. It was a legacy from the past which the present Governor and his colleagues were compelled to shoulder, and to do with it the best possible. Ten years ago the capital was £675 per million cubic feet sold, compared with the £566 obtaining now. This is a substantial reduction; but it does not alone disclose what has been accomplished during the period that the price of gas has been gradually lowered from 2s. 11d. to the pre-war price of 2s. 6d.—that is, since 1906, when Sir Corbet became Governor. The reduction of capital in relation to business has been brought about by three causes—by a fixed redemption allocation, by generous depreciation, and by a 20 per cent. increase in the consumption of gas without any addition to capital account. In the course of this same period—the years during which the consumers have derived so much benefit from the reductions, and the Company have been with each succeeding reduction placed in a stronger competitive position—there has been a great improvement in the general organization of the undertaking, and the works have been brought into a state of high efficiency. Co-partnership has been introduced, higher wages paid, dividends have been increased, and the Company's capital stocks previous to the war stood in greater favour than ever before. The reserves of the Company, too, have been considerably strengthened. In recent years, the burden of higher prices for materials has been borne, with the price of gas at 2s. 6d., through the aid of the funds put by during the years of price-reduction and prosperity. To give only a few of these points their concrete money value: The price of gas was reduced by annual penny reductions, during the five years, 1907 to 1912, from 2s. 11d. to 2s. 6d. While this gave upwards of £500,000 to the consumers, the dividend was raised from £4 8s. per cent. to £4 17s. 4d. per cent., about £400,000 was added to the carry-forward, the capital was reduced by about £100 per million cubic feet, and the special funds were increased by over £150,000. This is evidence of all-round fair treatment. We confess that we prefer the policy that has been pursued by the Board rather than that advocated by Mr. Paddon; and it is satisfactory to know that a policy that has been distinguished by such success is one from which the Board have no intention of swerving, given the enabling conditions. The Governor and his colleagues must be very grateful to Mr. Paddon for bringing forward the question.

To the confidence that has now been established among the proprietors in the policy of the present Board may be attributed the sparseness of the attendance at the meeting on Friday, despite the lower dividend due to the increase in the price of gas, and the demand that the trading conditions of the half year has made upon the carry-forward. The history of immediately past years supplies the proof that the confidence is well founded.

Gas-Works and the Coal-Tar Colour Industry.

THE suggestion was advanced last Thursday by the Chairman of the Commercial Gas Company (Mr. W. G. Bradshaw), in an address to the proprietors which contained many points of interest bearing upon the present situation, that, in the emergency of the British textile industries in regard to colouring matters through the closing of trade with Germany, the most suitable makers of aniline dyes would be the gas undertakings which produce the raw material. He added, however, that it would be impossible for them to erect the necessary expensive plant unless some form of assistance or protection were vouchsafed them for some years after the war. It is clear from the antecedent remark, "the Government has promised to assist in the "formation of an English Company to undertake the "manufacture," that Mr. Bradshaw's idea is that, given assistance or protection for a number of years, gas-works might enter on the intricate business of producing not only intermediate products and simple colouring matters, but synthetic dyes. The suggestion comes too late, even if it were a really practicable one. Gas undertakings, unfortunately for them, if not for the community, are not the only producers of coal tar; and they could not expect any favoured consideration or assistance from the Government over other tar producers. As to the practicability of their taking up the whole manufacture of dye materials, it is far too complex and specialized a business for a number of comparatively small units to engage in it with any hope of profitable result. Besides, the commercial risk would be enormous; for it will have to be a very strong protective barrier that, when peace is restored, will keep Germany from our shores, with all her resources and experience in the manufacture of her dye-stuffs.

For the success and security of this business here, the Government scheme of a special Company, properly supervised, is the better one, and with the Government and the users of dyes sufficiently interested to ensure the requisite protection for the new enterprise. But that is no reason whatever why gas undertakings engaging in tar distillation should not link-up with the scheme by going a certain length along the road towards meeting the requirements of the textile industries in this matter. There are several gas undertakings possessing tar-distillation plants; and there will no doubt be others before long with the opportunities presenting themselves for realizing a larger measure of value from their crude tar. But, for the purpose of enjoying some of the proceeds from the establishment of the dye colour industry here, ordinary tar distillation will have to be developed beyond the simple stages of current practice in most works, with the object of achieving greater refinement of the crude products of distillation. The process of fractional distillation will also have to be carried on, if the business, even to a partial extent, is to be entered upon with any hope of success by gas undertakings. The Gas Light and Coke Company are already erecting plant at Beckton for the purpose of replacing some of the articles hitherto supplied from Germany; and Sir Corbet Woodall intimated at the meeting of the proprietors on Friday, that this action would probably result in important business. It has not been to the credit of this country that, even to the small extent to which synthetic dye-stuffs have been manufactured here, the intermediate products required have been for most part purchased from Germany. Although this country is such a large user of dyes, it has never attempted to put itself about in the matter. Those engaged here in the distillation of tar have simply allowed themselves to be discouraged from enjoying their native opportunities by the prices at which Germany, through its greater enterprise, was able to sell the necessary intermediate products. The plant that the Gas Light and Coke Company are putting down is for the purpose of producing some of the simpler colouring matters for which there is immediate pressure, and for the manufacture of several of the "intermediates." Their enterprise, it is hoped, will be richly rewarded. But they have no intention of going to the length that Mr. Bradshaw evidently had in view when suggesting that gas undertakings as the producers of the raw material are the proper people to take up the whole business. What the gas industry can do is to share, by developments of their tar distillation practices, in the benefits that will accrue to the country by securely establishing here the coal tar colour industry.

The Manchester Coal Conference.

THE conference of representatives of gas-coal consuming municipalities at Manchester last Friday was a distinct success from the point of view of the numbers attending. To Mr. William Kay, the Chairman of the Manchester Corporation Gas Committee, and Alderman F. S. Phillips, the Chairman of the Salford Corporation Gas Committee, the response to their invitation—a response representing about 2¾ million tons of coal carbonized per annum—must have been very gratifying, although a good acceptance could not anyway have failed, seeing that coal supply is a question that at the present time overshadows all else in connection with the gas industry; the maintenance of the gas supply being a matter of primary importance to the great industrial communities (as to all others whatever their character throughout the kingdom) in the Lancashire and Yorkshire areas. The conference was called to decide upon the "best "measures" to be taken to meet the difficulty of a present shortage of coal, and the prospect of a further reduction in the supply. But a decision as to the "best measures" is rather a formidable matter. The problem appears, as Mr. Kay said in his address from the chair, to be a different one in different districts; and if it is so, then the solution

cannot be the same. In the Lancashire and Yorkshire districts, the administrations of gas undertakings are persuaded that there is a shortage in output; in the South, independent reports from the more northern coal-fields—Durham and Northumberland—assure us that there is a plentiful supply of coal there (partly owing to reduced exports), but the main difficulty is to get the coal transmitted from the Tyne to London and southwards in sufficient quantity through the scarcity of boats. An additional trouble is the ruling high freightage. But assuming the correctness of the shortage of output in some coal areas (which ought soon to be modified with the peak of the winter's demand passed), many gas undertakings down south which are purchasers from those fields will, of course, be concerned in the dual questions of shortage at the pits and the difficulties of transport. At any rate, the situation with reduced deliveries and depleted stocks, is one which (as Alderman Phillips said at the conference) is causing a great deal of uneasiness among gas administrations throughout the country. But unfortunately gas administrations are, acting individually, helpless in such a matter as this; and the best possible thing to do in the effort to produce remedy is to act in concert, as the Lancashire and Yorkshire gas undertakings are doing, and as the gas undertakings in and around London are doing.

The causes attributed by the coalowners for the shortage of coal at the pits, as stated by Alderman Phillips, and as published in the Press, are so at variance one with the other, that it would seem necessary that the coalowners should themselves hold a conference in order to get their explanations—some of which are no doubt sincere and well-founded, and some have the appearance of excuses—on to common ground, so that they may have some uniformity. Their case would then at any rate look better, and probably appeal with greater success for acceptance. The same with regard to the higher prices that are being charged for coal. The causes of the higher prices are not confined to the heavier costs of transmission, but to the extra prices charged at the pits, in justification for which the apologist of the coalowners—the "Iron and Coal Trades Review"—has been trotting out some of the stale reasons that have done duty for some time past, such as the "economic" law of supply and demand, and timber prices. Alderman Phillips is not by any means without support to his allegation that coal, which ought to have been delivered to gas-works under contracts, has been sent into the market by coalowners with the view to securing the higher prices.

However, the conference was called, as intimated, with the specific object of considering the "best measures" to be taken to meet the difficulty of the shortage of coal supplies. But there does not appear, judging from the report before us, to have been much consideration given to the question as to what are "best" remedial measures. The difficulty is not one that is subject to any haphazard solution. When the convening circular was sent out, it indicated pretty plainly that the view of Mr. Kay and Alderman Phillips was that the Government might take action under section 4 of the Mines' Eight Hours Act, and, by the suspension of the time-limit, supplement supplies by prolonging the hours of the miners—if the miners would work longer hours. Obviously something has happened since the circular went out; and that "something" we think is this: The Executive of the Miners' Federation last Tuesday passed a resolution protesting against the movement for bringing about a suspension of the Eight Hours Act, and pointing out to the Government that the shortage of supply is in no way attributable to the Act. The coal owners themselves are divided on the question as to the propriety of disturbing the present condition of things—some think it would have a beneficial effect on output, some are of opinion it would produce complications. We see no reason whatever why the Act should not be suspended. Section 4 was deliberately put into it for the purpose of bringing about its suspension if required; and when the section was framed, we undertake to say that such a world-wide state of upheaval as the present was never contemplated. It may have been the attitude of the Miners' Federation Executive on the subject that caused the conference on Friday not to put forward the suspension proposal as the measure that was considered "best" in the circumstances, but to rest content in the passing of a resolution making representation to the Prime Minister as to the seriousness and urgency of the position, and asking him to take the necessary steps to increase the output of coal, as well as the facilities for its transport in any practicable manner. Arrangements were also made for a deputation to seek an interview with the Prime Minister to lay the matter before him. A similar step has been taken in connection with the perilous position of the coal supply to gas-works in London and the neighbourhood.

To meet any shortage of output at the pits, the only way it seems to us that the Government could effectually move, providing the miners were prepared to do extra work, would be by the proposed suspension of the Eight Hours Act; and there is no question this was the line preferred and uppermost in the minds of those at the Manchester conference. But the resolution of the Miners' Federation Executive no doubt unpleasantly obtruded itself into the path of an open expression of opinion. There is here a question at issue between duty and that mistaken principle of basing wages on the ruling prices for coal. We do feel, however (despite the resolution of the Miners' Executive Committee), that if an appeal were made to the leaders and the men on patriotic grounds—an appeal to them to serve the country in its extremity in regard to coal, an extremity occasioned not by ordinary circumstances that control the rise and fall of coal values, but by conditions of an unprecedented nature—they would respond just as generously as their comrades did to the appeal for men to serve at the front. Outside the main resolutions, the best suggestion made at the conference was by Captain R. S. Hilton, the General Manager of the Birmingham Corporation Gas Department. He said he believed that, if the Government were approached with the idea of calling a round-table conference of coalowners, railway authorities, trade union representatives, and large manufacturers, some arrangement might be arrived at by which the present output could be increased. Through the period of the war, the chief labour representatives, with an exception or two (whose chosen *rôle* is always to be exceptions on any matter), have shown themselves as patriotic as any men, and so have the miners. Here there is a matter in regard to which those at home can testify to a larger patriotism still; and at a round-table conference such as is suggested by Captain Hilton, the labour representatives would not, we feel, prove recalcitrant if it could be shown that the suspension of the Eight Hours Act was needful to produce relief for the country in the matter of coal supply under the present exigent conditions.

A New Radiometer, and Some Criticisms of the "R.H.S." Instrument.

In other columns this week, we publish the first part of an article by the Technical Staff of the Richmond Gas Stove and Meter Company, which part consists of a critical examination of the shortcomings of the central instrument in the equipment for the Leeds test—the "R. H. Smith" radiometer. In the second part of the article (which will have to be deferred for a short time) we shall publish a description of a substitute—in connection with which a patent application has been lodged—together with the method of use, in and by which it has been sought to avoid the sources of error and the waste of time inherent to the old type of water-flow radiometer. That there has been success in this latter regard has *primâ facie* proof in the results of a long series of tests, some of which are embodied in the article. The work, the findings and issue of which are concentrated in the communication, began about eighteen months ago—rather more in fact; and, knowing something of what has been going on in connection therewith, we can now heartily congratulate the Technical Staff of the Richmond Company upon the thoroughness of the exploration made into the whole matter, and upon the ingenuity which has evolved a simple form of radiometer which will not (we are persuaded from close observation) be subjected to the vicissitudes of fortune of which the "R.H.S." instrument is the acknowledged victim.

In introducing a suggested departure of this kind from the apparatus of the Leeds test, which test is the only recognized standard for the measurement of the radiant efficiency of gas-fires, it is appropriate that acknowledgment should be made of the fact that it was the Gas Engineering and Fuels Department of the Leeds University that gave to the gas industry the real starting-point in the scientific testing of gas-fires. Too much credit cannot be assigned to the Leeds University in this connection; for there is no denying that the devising of the test (if not absolutely reliable in all particulars) supplied a very big incentive to gas-fire development, which has given the industry, during

the last few years, the enormous gain in efficiency which has tended to popularize gas-fires, it is safe to say, more than any other factor. Though this be true, and the credit large for the provision of a standard test, it was not until the test came to be applied by competent hands outside the care and watchfulness of the University laboratory, and amid the more strenuous life of the works' laboratory, that its deficiencies for general application were fully disclosed. The first public criticisms that were made of the most vital part of the Leeds equipment were, to the best of our recollection, by Mr. Harold Hartley, M.Sc., the Chief of the Technical Staff of the Richmond Company, in a lecture before the Yorkshire Junior Association in November, 1913. That his criticisms were justified have been fully attested by subsequent events. In the lecture, it was deliberately stated that the "R.H.S." radiometer would not give correct results, and that it needed additional heat protection. The allegations were not advanced without good ground for them. And here let us say that the Richmond Company distinctly deserve every credit for making a detailed investigation into the matter such as, so far as we are aware, had not been previously undertaken. The work showed that an improvement in the "R.H.S." radiometer results could be obtained by increased insulation, but that the wind shield would still interfere with the results. The greatest difficulty was in connection with the cooling correction, the application of which is extremely important, though it was never emphasized or discussed in the reports of the Gas-Heating Research Committee. However, in the Richmond Laboratory at Warrington, it has been found that if the "R.H.S." radiometer is used under such conditions that the cooling correction can be eliminated, then the best results are apparently obtained. These remarks indicate where the principal sources of error lay in connection with the use of the "R.H.S." instrument; and the discussion of these sources of error supplies in large part the section of the contributed article which, in effect, is a complete case for the need of the supersession of the existing radiometer in the Leeds test if an improved one—giving accuracy with less labour, and saving time in busy works' laboratories—is available.

Destructive criticism, if warranted, is all very well up to a point; but when the destructive criticism is accompanied by something of a constructive nature, it is far more acceptable. Discovery of errors was followed by a search for some means of eliminating them; hence a totally new design of instrument is suggested. In the works' laboratory—whether the works be those of the gas-fire manufacturer or of the makers of the gaseous fuel for the fires—time is a matter of inestimable value; and one of the primary objects kept in view by the Richmond Company's Technical Staff in considering the lines of a suitable substitute for the radiometer incorporated in the Leeds test, was that of economizing time. In achieving this, they have been eminently successful. One important feature of the new radiometer is that a constant temperature room specially constructed or adapted for gas-fire testing purposes—which has been one of the obstacles to the universal application of the original Leeds test—is not essential.

It seems to us that the accuracy attainable with the new apparatus, when a detailed efficiency test is carried out, is no longer really determined by the radiometer itself, but by the accessories to the test. A detailed test involves thirty-two temperature observations, and a corresponding calculation for cooling correction. Such a degree of accuracy as this ensures would not often be required; and we are satisfied that a result correct to within 1 per cent. (which in all conscience is sufficiently near) can be realized by making only four temperature observations—the calculation of the results from these being a matter of extreme simplicity. On this part of the test, the operator is only engaged for sixteen minutes; and the radiometer does not, during that time, by any means monopolize his attention. This being so, he can simultaneously attend to other of the auxiliary determinations—such as gas consumption and calorific value. Not to put too great credit upon the time-saving merit of the new instrument, it is well within the mark to say that by its use the radiant efficiency of nine fires can be tested in a nine-hour day, whereas with the "R.H.S." radiometer not more than two can be satisfactorily tested.

In the application of the new radiometer, there is adherence to the principle of the Leeds method, which possesses the important attribute that it enables determinations to be made of the distribution of the heat from a fire. What therefore the new instrument does is to raise the "efficiency" of the Leeds test, while substantially simplifying it, and cheapening equipment. Furthermore, it combines accuracy with practical service; and thus is an advance that should have considerable bearing in bringing about the more general testing of gas-fires for their supreme essential of radiant efficiency. It will have been readily appreciated from what has already been said that testing with the new instrument (which is portable) is a matter of extreme simplicity; so much so that the staff of any gas undertaking can, by its aid, institute tests with the fullest confidence as to the accuracy of the results. When we speak of "accuracy," the term is, of course, used subject to the exercise of intelligence and ordinary care. Scrutinizing both instrument and methods with the express view of trying to detect seats of weakness, it is impossible to see where errors can arise, excepting by inadvertence. The only calculations that it involves are simple arithmetic. Then, as to cost. Judging the instrument from the structural aspect, we should imagine that its cost should be considerably less than that of the Leeds apparatus. Given accuracy and rapidity of testing, the time is bound to come when every responsible gas manager will refuse to buy any gas-fires, the same as in the case of his raw materials, other than (so to speak) upon the basis of "quality." He will consider radiant efficiency, tested in the laboratory on his own works, pre-eminent among the qualities which go to make up the excellencies of the good gas-fire. He will no longer be content to accept unchecked the efficiencies ascribed by makers; and he may depend upon it that elasticity in this regard, wherever it may have existed, will gradually disappear with the growth of check-testing by buyers. The makers of high-class fires will also prefer, in the interests of the expansion of the gas-heating business, that purchasers' tests should be made, in order that merit in regard to radiant efficiency may be a positive, or rather a still greater, commercial advantage to them. While there are fires on the market with radiant efficiencies assigned to them that cannot be substantiated by actual test, the commercial value of real higher merit in this respect is assailed, unless gas managers themselves put the fires under test, and a test in which local conditions as to gas supply obtain. There is confidence in saying that we are on the eve of a great change in this connection; and such work as the Richmond Company have been doing will contribute to the desirable end. Incidentally, it proves that they place great reliance on the high radiant efficiency of their own particular fires.

Gas Oil Imports.

Whatever is happening in regard to coal, there appears to be almost a plethora of gas oil available. The trouble in regard to coal is the oil importers' opportunity. Recently attention was called to the excellence of the supply during the period of the war; and the inflow to store has not abated during the opening weeks of this month. The "Petroleum Review" has been struck by what is happening in this regard. On more than one occasion lately, it has made special mention of the matter. For the last week of January, its records show the arrival of upwards of 4 million gallons of gas oil—mostly consignments of the Anglo-American Company.

Chemical Manufacturers and the Dye Scheme.

The chemical manufacturers seem in a perpetually discontented frame of mind. The gas industry had a taste of their discontent in 1912; and it has since learned something about the covert methods of warfare to which they are capable of having recourse when it suits them. Now it seems the chemical manufacturers are not at all pleased with the Government dye scheme. According to the Chairman of the Institute of Industry and Commerce (Mr. J. Taylor Peddie), from the standpoint of the chemical and allied industries, the revised scheme is no better but worse than the original one. The real cause of complaint on the part of the chemical manufacturers is that the Committee dealing with the matter at the Board of Trade is a Committee of users of chemicals, and not a Committee of chemical manufacturers. It seems to us that the Committee of users is a very proper one, as it is upon the loyalty of the users that the protection of the home colour industry depends in the future beyond the war. But Mr. Peddie, with superior knowledge, says the proper course for the Government to follow is to consult with a Committee of chemical

manufacturers, and obtain their approval of any scheme which is put forward, and not endeavour to rush through a scheme which, in all its essentials, is unsound and unfair to the chemical industry as a whole. It is not explained why the Government should trouble to obtain the approval of chemical manufacturers who have not hitherto bestirred themselves in any way to try to capture the coal-tar dye and colour industry from the Germans, nor voluntarily and promptly come forward with a scheme for filling requirements and taking over Germany's trade, when the industries using dyes and colours found themselves in a predicament in regard to supplies. They did not show much, if any, original activity; but now a scheme has been put forward by someone else, they come on the scene as critics and grumblers, and feel they have a legitimate grievance. If they had shown an early activity instead of a conspicuous lethargy, they might now have been taking a prominent part in the scheme. Where the unfairness to them comes in is not at all plain. Some people are rather good at seeing others plant plum-trees, and then becoming possessed of a strong desire to share in the fruit.

The Men at the Front.

The British gas industry is exceedingly proud of the number of men that it has serving in His Majesty's forces, and fighting for the nation's honour and for vital and human principles. To the pride, expression is being given at the meetings of gas companies now being held up and down the country. It was so at the meeting of the Tottenham Light, Heat, and Power Company on Saturday; and a very good suggestion was then made by one of the proprietors—Mr. Herbert Michel—in regard to the matter. It was to the effect that steps should be taken by the Directors to let each man individually know of the appreciation of the proprietors at his act of self-sacrifice and devotion to the country. The Chairman (Sir Corbet Woodall, D.Sc.) promised that this should be done. No doubt many other companies will follow this example. A question is which is the best way for such a communication to be made. We can conceive of no better method than that a print of the report of the meeting of the employing company should be sent to each man. Absent, the men will be glad to learn how things during the months of war have gone with the concern in whose service in normal times they are engaged.

Cold and Coal.

For the gas-heating business, the recent snow, sleet, and low temperatures had too short a spell; for personal comfort, one very soon has enough of such conditions. Under the circumstances, too, of the high prices ruling for coal—particularly the retailers' prices for small quantities—we are glad for the sake of the poor to see an end to winter's frigidity, and for this reason, though the gas industry will be the sufferers, there is no desire to witness its return. But that by the way. Inquiries in different quarters show that, despite the economic conditions obtaining in the various social zones, the gas-fire business this winter has not been at all a bad one, though, generally speaking, not reaching the heights of what became the normal experiences of the past three or four heating seasons. In some districts, the partial failure in the matter of supplies of the coal merchant, and the high price of coals, created for some weeks quite a rush for the handy gas-fire—householders, as at the time of the national coal strike, showing an inclination to put upon the suppliers of gas the responsibility of keeping them warm. This responsibility the gas suppliers cheerfully undertook, though transport derangement and heavy costs were not causing them to feel at all comfortable over the position. Now we shall be day by day moving towards more open and warmer weather. The pressure for household coal will be less stringent; and the time for gas-works making up their coal delivery arrears, and stocking against fresh emergencies, will be opportune.

Seasonal Signs.

In the life of an industry such as gas making and supplying, there is an unbroken continuity. In some other industries, it is possible to close-down and start-up again at will, or as occasion demands. With the gas-supply industry this cannot be done. It is an industry that has, more or less, special seasonal claims upon it. Our advertisement columns are an index to this. No sooner is autumn here, than makers of gas-fires are drawing the attention of gas engineers and managers through their trade announcements, and in other ways, to the new heating goods upon which they have been working during the time that Old Sol has been fulfilling his task—sometimes to excess—of keeping the world and humanity warm. As the winter begins to draw to a close, we see the signs of seasonal change again in our advertisement columns. The makers of domestic gas appliances depart in subject-matter and illustration from gas-fires to cookers, water heating apparatus, and other goods. Changes in the advertisements of manufacturers of gas-cooking appliances have already this season commenced to make their appearance. Now is an especially good time to push the water-heating business, when people are beginning to consider what they will be undertaking this spring in the way of renovation and alteration in their domiciles.

Industrial Gas Heating.

There is another line of business in which this year is going to witness a large amount of activity. That is industrial heating. Yesterday, Brayshaw Furnaces and Tools, Limited, commenced an exhibition at Sheffield, with the view of bringing their industrial gas-heating specialities before the manufacturers in that busy city and the adjoining area. The exhibition, which will be well worth a visit, is going to continue about a month; and at intervals during the time considerable interest is promised in the shape of lectures by men who are expert in the subject of industrial heating and in the measuring of high temperatures. Particulars of the exhibition and programme are given with more detail in other columns. Then, at the Royal Society of Arts, Mr. H. M. Thornton is down for a lecture next month on the subject of the utilization of gas for industrial heating. The paper that Mr. Thornton read before the British Commercial Gas Association at the 1913 conference at the National Gas Exhibition was a revelation to many gas men as to the extent of the applications of gas in industry, and as to the enormous scope still existing; and so too was his subsequent lecture at Newcastle. The reputation in this particular line of Messrs. Fletcher, Russell, and Co. extends back to the very beginning of the utilization of gas in industrial operations; and we see they are also, through their current advertisements, pushing this particular business. Such activity on the part of the makers of gas furnaces, crucibles, and other industrial apparatus should stimulate gas salesmen in every district to make inquiries as to the heating needs of local industrial establishments, and investigate the matter of displanting at any rate coal by gas. There is now plenty of testimony at hand as to the economy and collateral advantages of the gas-heating system in our manufactures.

Claim for Injuries at Ilford.

At the West London County Court last Friday, Mr. Frank Ainsworth, a gas inspector who has had fourteen years' service with the Ilford Gas Company, claimed £100 damages from Major the Hon. Walter Guinness, M.P., for injuries caused by a motor-car. On the afternoon of Oct. 27 last, plaintiff said, he was crossing with his bicycle from the left of the High Road, Ilford, near Seven Kings Station, to some of the Company's men on the opposite side. For the defence it was stated that Mr. Ainsworth was on the left side of the tramlines; but he and his witnesses contended that he was on the crown of the road, and passing on to the second set of the double track of tramlines, when a powerful motor-car driven by the Major's chauffeur came behind, sounded the hooter, and at the same moment caught plaintiff on the right hip with the left corner of the front-wheel guard, threw him on to his shoulders and head, and also injured the small of his back. He was away from work for seven weeks; and is only now beginning to feel himself again. The defendant's chauffeur stated that he was driving the car, in which were his employer's two children, a nurse, and nursemaid. One of the children had just undergone an operation; and he was instructed to drive carefully. On passing through Ilford, he overtook the plaintiff, who, when they were level, suddenly turned to the offside. Witness tried to avoid him; but the cycle caught the front wheel of the car. Mr. Ainsworth refused what he regarded as an inadequate offer to settle the matter (made with a denial of liability), and brought his claim before the Court. He, however, lost the case, and thus has, his friends in the London and Southern District Junior Association and elsewhere will regret to learn, suffered a double misfortune.

PERSONAL.

Mr. A. F. PHILLIPS, M.Inst C.E., has been elected Chairman of the Harrow and Stanmore Gas Company, in place of the late Mr. A. H. Baynes.

The half-yearly accounts of the three London Gas Companies, which were given practically in their entirety in the "JOURNAL" last week, were signed by Sir ALFRED E. BATEMAN, K.C.M.G., who has succeeded the Hon. T. H. W. PELHAM as the Official Auditor under the Metropolis Gas Acts.

Owing to continued ill-health, Mr. JABEZ LIGHT has retired from the Board of the South Suburban Gas Company, of which he was a member for more than thirteen years, during six of which he occupied the position of Deputy-Chairman. The Directors have placed on record their appreciation of the valuable services rendered by him to the Company, and have elected Mr. HAROLD GUNDRY, barrister-at-law, to fill the vacancy caused by his retirement.

Previous to leaving the Saltley works of the Birmingham Corporation Gas Department, in order to take up his new position as Works Superintendent to the South Suburban Gas Company, Mr. F. G. GORMAN was presented by the staff with a handsome Chippendale smoker's cabinet, as a token of the high regard in which he is held. The presentation was, in the unavoidable absence of Mr. W. Chaney, the Engineer, made by Mr. James Hewett (Distributing Engineer), who referred to Mr. Gorman's particular fitness for the important position he had obtained, and said his success reflected no small honour on the Birmingham staff. In returning thanks, Mr. Gorman referred to the happy times he had spent at Saltley and Nechells, and to the fact that this was the second occasion on which he was bidding adieu to the Birmingham Gas Department. He also alluded to the consideration which Mr. Chaney had at all times shown him.

OBITUARY.

The death occurred recently of Mr. H. T. DOBLE, formerly Chairman of the Tavistock Urban District Council, and for a great many years Chairman of the Tavistock Gas Company. At the funeral, which took place on the 30th ult., the Company were represented by Messrs. T. Doidge and J. Snow (Directors), Mr. C. Stapleton (Manager), and Mr. W. D. Eddy (Secretary).

By the death, on the 29th ult., in his sixty-seventh year, of Mr. MATTHEW HENRY DANILY, Malpas has lost one of its most prominent and respected residents, and the Gas Company their Chairman. Deceased was elected first Chairman of the Parish Council —a position he held till his death—and he was a member of the Rural Council and of the Whitchurch Board of Guardians.

Mr. W. EDGAR ALLEN (founder and chairman of the well-known firm of Edgar Allen and Co., Limited, Imperial Steel Works, Sheffield) died on Jan. 28, at the age of 77. For several years he had not enjoyed robust health, and had been ill since October; but his death, nevertheless, came as a surprise. The loss of Mr. Allen will be keenly felt in Sheffield; for besides being a munificent benefactor to the University and the city, the energy and skill with which he managed his business affairs led to the building up of one of the most active steel businesses in the district. It was in 1868 that he established the firm, which subsequently extended its connections almost all over the world. So large, in fact, has the business become that now practically £200,000 is paid away annually in wages and salaries.

Wolverhampton has just lost a prominent burgess in the person of Alderman BERRINGTON, who died on the 24th ult. in his sixtieth year. He was a native of the borough, and early in life was associated with the town's water-works, qualifying later as a civil engineer. In 1886 he was appointed Borough Engineer, having acted previously as Assistant Surveyor and Engineer. While holding this important post he designed and carried out the town sewage scheme. In 1894, on his retirement, he commenced private practice, specializing in works of water and drainage. He was a member of the Institution of Civil Engineers, the Institution of Water Engineers, and the Association of Municipal and County Engineers; and he was a Fellow of the Sanitary Institute and of the Geological Society. He was Mayor of Wolverhampton in 1904-5, and in the latter year was elected an alderman.

Proposed Combination in the Heavy Chemical Trade.—The following appeared in the "Chemical Trade Journal" last Saturday: "The rumour has gained ground during the week that a combination of British heavy chemical manufacturers is in process of formation. This, no doubt, is the outcome of the meeting held last week in London under the auspices of the Institute of Commerce and Industry, though at the time of writing no information has been allowed to transpire. The object of the movement, it is believed, lies in the formation of a mutual protective and defensive association with particular regard to the retention of the trade which has been captured or recovered from the German and Austrian producers of alkalis, bleaching powder, cyanides, arsenic, sulphate of copper, and other heavy chemicals, including coal-tar products. Should the movement mature and a combination of manufacturers come into being, far-reaching developments in the heavy chemical trade may be looked for."

DEATH OF MR. R. FORBES CARPENTER.

THE announcement of the death on Monday last week, at his residence at West Hampstead, of Mr. Russell Forbes Carpenter, who for some years filled the position of Chief Inspector under the Alkali Works Regulation Acts, will, we are sure, be read with regret by the large number of gas engineers and managers with whom he had official relations. He had been in ill-health for some time—indeed, this was the cause of his relinquishment of his position not quite five years ago. The trouble was, we understand, accentuated by an accident sustained while journeying from the Continent early last August; and his death, in his sixty-ninth year, was the result of heart failure.

Mr. Carpenter was the son of Mr. W. B. Carpenter, F.R.S., Fullerian Professor of Physiology at the Royal Institution, and Lecturer or Professor at the London Hospital and University College. He was also a nephew of Mary Carpenter, the well-known philanthropist. He was educated at University College School and University College, where he had a somewhat distinguished career. While at college, working under Professor Williamson, F.R.S., the Chief Gas Examiner for the Metropolis, he was asked to act as guide and instructor to the first three Japanese who succeeded in escaping from Japan to seek instruction in England. Later he became acquainted with the Marquis Ito, by whom he was warmly welcomed when the Marquis visited England in recent years. When Mr. Carpenter left University College he obtained an appointment at the Royal Mint as assistant to Professor Graham, who was then Master. From the Mint he entered the service of the Netham Chemical Company at Bristol; but ill-health compelled him to resign; and he undertook a long sea voyage with the view of obtaining some improvement. On his return to England, he commenced his official duties. On Jan. 31, 1882, he was appointed a Sub-Inspector under the Alkali Act; became an Inspector on July 25, 1884; and the following year succeeded Mr. Alfred E. Fletcher as Chief Inspector. This position he had to relinquish through failing health in April, 1910, and his duties were entrusted to Mr. William S. Curphey, the Inspector for Scotland.

It is not necessary to refer here in any detail to the late Chief Inspector's work, as the copious extracts from his annual reports which appeared in the "JOURNAL" afforded ample proof of the excellent manner in which, with the valuable co-operation of his Assistant (Mr. S. E. Linder, B.Sc.) and the staff of District Inspectors, his duties were performed. Suffice it to say that, in the long period during which he held the office, he won the esteem of everyone with whom he was brought into contact. It was the human relationship which he established, in spite—one might also say in defiance—of the official environment in which he had to work, that is the best testimony to his work. He possessed remarkable organizing powers, and he had a large share in framing and passing the Alkali, &c., Works Regulation Act of 1906, which consolidated the Acts of 1881 and 1892. This Act brought within its scope works which it had been considered desirable to include; and great opposition was at first offered to it by manufacturers. Owing, however, to Mr. Carpenter's tact, their objections were overcome.

Mr. Carpenter was a Fellow of the Institute of Chemistry, and served on the Council. He was also one of the Censors in 1908-9. He was an original member of the Society of Chemical Industry, and in 1894 was appointed Chairman of the Manchester Section. This position he relinquished in 1895, on being appointed Chief Inspector of Alkali Works, which was followed by his removal to London. During his residence in the Metropolis, he became one of the Vice-Presidents of the Society. He served on the Council of the National Physical Laboratory, in the work of which he showed the greatest interest. Mr. Carpenter was one of the founders of the Manchester Chemical Club; and, in recognition of his ability, and of the interest he manifested in it, he was elected an honorary member when he removed to London. He was upon the Committee at the time of the election, on Jan. 30, 1891, of the present Hon. Secretary, Mr. J. T. F. Bishop, who is now in his twenty-fifth year of office. In sending yesterday some notes of Mr. Carpenter's career, he said: "All the way he was my very dear friend; and all who knew him must have regarded him as a gentleman fitted in every sense to fill the high office of Chief Inspector. He will ever be remembered.

The funeral took place last Thursday at Highgate Cemetery.

AN APPRECIATION BY MR. ERNEST LINDER.

It is in willing response to the Editor's request, but with a somewhat heavy heart, that I endeavour to set down a few recollections of Russell Forbes Carpenter, my late revered chief and friend. So much that is stored in my memory is entirely personal to myself and within the sanctity of domestic life, that I am doubtful how far I am qualified to speak. The external activities visible to the world seem, at such a time as this, of little worth in comparison with the inner thoughts and confidences that I was privileged to share for so many years, and that cannot be made public.

I was first engaged as Assistant to Mr. Carpenter in 1895, when he succeeded Mr. Alfred E. Fletcher as Chief Inspector of Alkali, &c., Works, and continued to serve him in that capacity until his

retirement from office in April, 1910. Mr. Carpenter's powers in 1895 were fully matured, and at that date he enjoyed a fair measure of health and strength. Work was then a pleasure to him, and the heavy responsibilities of his high office were, I think, a relaxation rather than a burden. "Work," he once said, "is my hobby; the very smell of a chemical works raises my spirits." With Sir Walter Scott he might have said: "I consider the capacity to labour as part of the happiness I have enjoyed." How different were the closing years of office, when, with shattered health and clouded mental vision, he struggled with pathetic loyalty to fulfil his high conception of public duty.

A lofty—indeed, a stern—sense of duty was the most noticeable trait in Mr. Carpenter's character, and sustained him when life seemed to have lost all power to solace and to please. He ruled his own spirit with inflexible purpose, and from those who served him he expected the same unswerving obedience to higher law. But even at times of greatest pressure he never forgot what was due to others, and never laid on them burdens that he was unwilling himself to bear, nor did he hesitate to undertake subordinate work if needed relief was brought to another. His mind at its best was extraordinarily alert and active. He rarely delayed judgment on administrative matters submitted to him for decision; and business that could by any possibility be despatched to-day was never left over till to-morrow. He was extremely tenacious of opinion, not from real reluctance to admit defeat, but from a masterful confidence in his own rightness of decision. It was sometimes difficult for him to appreciate another's point of view; but he was essentially a just and fair-minded man.

In administration, Mr. Carpenter's greatest achievement was the consolidation of the Alkali Acts of 1881 and 1892. In 1898 the wording of the Act of 1881 was found to be so defective as to imperil administration. Amendment, under the parliamentary conditions then prevailing, seemed to be hopeless of accomplishment; but with characteristic energy he laboured to achieve success, and after eight years of unremitting toil the Alkali Act of 1906 became law. But so long as strength remained Mr. Carpenter was never content to confine his energies to the immediate duties of administration. He served with much distinction on the Councils of the Society of Chemical Industry, the Institute of Chemistry, and the National Physical Laboratory. In all that tended to advance the bounds of knowledge he took the keenest interest, and in research work especially his enthusiasm and unfailing encouragement and support were a source of inspiration to all who helped him to give practical shape to his ideas. Mr. Carpenter was ever eager to discuss technical problems with those whose judgment he respected.

At the close of his Forty-Fourth Annual Report, Mr. Carpenter wrote:

> One of the privileges of the last ten years in my visits to Scotland, and one that I every year looked forward to with zest, was a visit to talk over with Mr. Young (of Peebles) the technical problems both of the present and of the future that claimed our attention. He rejoiced that a Government Department had been administered . . . on the wise lines of endeavouring to help people in their difficulties in attaining an end common to both . . . viz., that of reducing to a minimum the nuisance proceeding from their operations, and at the same time securing, where possible, economies in manufacture, and the preservation for the country's ultimate benefit of products hitherto destroyed and wasted.

Such was Mr. Carpenter's ideal. He sought to reconcile conflicting claims, and advance the well-being of the community; and to this end he consecrated the best powers of his life.

Iron and Steel Institute.—The annual meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on May 13 and 14. It has also been provisionally decided to hold the autumn meeting in London during the week ending Sept. 25.

Midland Junior Gas Association.—A visit was to have been paid on Saturday next to the Warrington works of the Richmond Gas Stove and Meter Company; but this it has been found necessary to postpone. In its place there will be a meeting in the City of Birmingham Technical School, when members will discuss the question as to whether the adoption of commercial methods in gas undertakings has done more than works practice to reduce price and increase consumption. Members are also invited to bring forward matters on which they desire information.

Latent Heat of Vaporization of Carbon.—According to Mr. C. Hering, writing in "Metallurgical and Chemical Engineering" [Vol. XII., p. 526], the energy liberated when solid carbon combines with gaseous oxygen—$C + O = 26{\cdot}1$ kilo.-calories, and $C + O_2 = 94{\cdot}3$ kilo.-calories—is represented by the difference between the chemical energy of combustion and the physical energy required to render the carbon gaseous. Richards estimates the latter value at 45·7 kilo.-calories. By reducing this figure from 45·7 to 42·1 (about 9 per cent.), the equations are $C + O = 26{\cdot}1 + 42{\cdot}1 = 68{\cdot}2$ (which is identical with $CO + O = 68{\cdot}2$), and $C + O_2 = 94{\cdot}3 + 42{\cdot}1 = 136{\cdot}4$ or $68{\cdot}2 \times 2$ kilo.-calories. It would thus appear that carbon develops exactly as much energy in combining with the first atom of oxygen as it does with the second.

CONFERENCE ON COAL SUPPLIES.

Important Meeting at Manchester.

In response to a circular-letter issued on Jan. 28, jointly signed by Mr. William Kay, the Chairman of the Manchester Corporation Gas Committee, and Alderman F. S. Phillips, the Chairman of the Salford Gas Committee, there was a representative gathering of Gas Engineers, Managers, and Secretaries, as well as Chairmen of Gas Committees and others closely allied with the industry, at the Lord Mayor's Parlour, Manchester, on Friday afternoon. One hundred-and-two invitations had been extended to the meeting, and forty-two municipal undertakings were actually represented at the meeting. In addition, several local private companies were represented. The municipal authorities who were represented were as follows, the figures in parenthesis denoting the number of representatives attending:

Birmingham (1), Birkenhead (2), Bolton (2), Blackburn (4), Bradford (2), Burnley (2), Bury (2), Carlisle (1), Chorley (2), Clitheroe (3), Dewsbury (1), Darwen (2), Dukinfield (2), Doncaster (2), Heywood (2), Ilkeston (1), Keighley (1), Lancaster (1), Leicester (1), Macclesfield (3), Middlesbrough (1), Middleton (1), Morecambe (1), Mossley (3), Nelson (2), Oldham (1), Ossett (2), Rochdale (1), Retford (1), Stockport (2), Smethwick (2), Stalybridge (2), Southport (3), Workington (2), West Bromwich (1), Warrington (3), Walsall (2), Dewsbury (1), Manchester, Salford, and Altrincham (1).

In addition to the above, the following undertakings were unable to be represented, but were stated to be in sympathy with the object of the meeting: Nottingham, Batley, Coventry, Lincoln, Ramsgate, St. Ives, Haverfordwest, Darlington, Brighouse, Kendal, and Huddersfield.

The circular-letter was couched in the following terms:

> "In view of the great shortage of coal supplies, and the prospect of further reduction in such supplies, the position of the gas undertakings of the kingdom becomes one of considerable anxiety. The Gas Committees of Manchester and Salford are of opinion that, in the common interest, it is desirable that a conference on the situation should be held to decide upon the best measures to be taken to meet the difficulty. Their attention has been called to the Mines Regulation Act of 1910, which by section 4 reserves means of suspending the limitation to eight hours' working, and they consider that strong combined representations should be made to His Majesty's Government to give effect to these powers for the period of the duration of the war."

The Lord Mayor's Welcome.

The Lord Mayor of the city, Alderman Daniel M'Cabe, J.P., said he had pleasure in welcoming the visitors to consider what to his mind was a very important matter. He was given to understand that forty-two municipalities were represented, whose gas consumers aggregated 1,037,000, with a product of something like 2,774,965 tons of coal to carbonize. This showed that the industry they represented was not only a considerable one, but it was an important one to the communities represented. He hoped that the deliberations that afternoon would be profitable. Without further ado, he proposed to ask Mr. Kay, the Chairmen of the Gas Committee, to preside over their meeting.

Mr. William Kay, having taken the chair, remarked that the difficulty which had arisen was one which could be well met—and should be well met—by the determination of the nation, when war broke out, that all should work together for the common good. It was with this intention that Alderman Phillips and he had asked them to assemble that afternoon. It was, as they would recognize, important that they should not have a depreciating coal stock at this time of the year, because it would be difficult to make it up in the summer. There might be some trouble in replenishing stocks before next winter; but, at any rate, the matter which they were about to discuss was one which called for decisive remedial measures, if possible. They had with them that afternoon Captain R. S. Hilton, of Birmingham, who had waited upon most, and probably all, of those present with regard to the question of toluol. The collection of toluol was a most important matter. He (the speaker) had also asked Mr. Macintosh Williams to address them on this matter, because what had already been explained to him showed the necessity of co-operation with the Government in this important question. With regard to the question of the shortage of coal, he (Mr. Kay) was of opinion—and he thought they would all agree with him—that various districts were differently placed; similarly, different districts had different troubles to contend with. A conference such as theirs that afternoon could be productive of nothing but good. It was a matter of primary importance, and, he hoped, likely to attain the end they all desired—to be of benefit to their consumers, and enable them as engineers to bring their troubles to a successful issue. The speaker concluded by asking Alderman Phillips, the Chairman of the Salford Corporation gas undertaking, to further enlighten them on the subject now about to be dealt with.

Alderman Phillips on the Situation.

Alderman Phillips said the reason why the gathering was convened was to confer upon what he thought would be found to be a common difficulty. This difficulty had caused many of them a great deal of serious consideration; and the outlook was not satisfactory. What steps were to be taken to find a remedy? It was in conference with those present that they hoped to find the remedy. In the first place it was, no doubt, common knowledge and ex-

perience that coal stocks which were retained against times of emergency had been depleted—a situation which caused some disquietude. In Salford, for instance, they had made considerable inroads into their stock; and despite all they had done to insist upon deliveries of coal, they found the necessity of going further into their stock. Further, also, it would probably be common experience that circulars had been sent out by colliery owners and others that owing to lack of labour, and having lost so many men by reason of their having joined the Colours, there were not so many men at work in the pits to maintain their usual output, but that they were prepared to divide proportionately their products. Throughout Lancashire, Yorkshire, and the Midlands, and in all parts of England, except Durham and Northumberland, there was a greater demand for coal than the supply. In these districts—Durham and Northumberland—owing to the difficulties about freightage, and the troubles with regard to exports, there was, perhaps, a slackness. But it did not help them, as engineers, in the present difficulty of obtaining sufficient supplies. A communication which he had received from the South Wales district from a colliery—he could not mention any names—said that "great care had to be taken to keep Admiralty orders going, as they had, of course, first call upon their resources." In another case a colliery owner wrote that "he looked into the future with the most serious misgivings." Yet another alluded to the shortness of waggons; while another declared that "owing to the shortness of material they would be compelled to suspend contracts." A further letter ran: "I am in favour of the proposal to ask the Government to suspend the Eight Hours' Act at the present time." The statement of another was "shortage of labour owing to so many men having joined the Army." Another colliery owner wrote: "I have no hesitation in supporting the proposal to ask the Government to suspend the Eight Hours' Act, so that the supplies of coal to gas companies can be better dealt with." One other colliery owner stated, in his reply regarding non-deliveries, that he was "strongly of opinion that the Eight Hours' Act should be suspended, as the difficulty in maintaining supplies was so acute, and things had the appearance of becoming worse, owing to the difficulties of transport." Another of his correspondents stated that in his particular district he found that 20 per cent. of the colliers had enlisted, and this included men on the surface and in the offices. Some collieries, proceeded Alderman Phillips, were not able to put out sufficient quantities of coal, because there was an insufficiency of railway waggons to take it away. Undoubtedly, it was the fact that some of the coal now going to London at very high prices really belonged to gas undertakings that had contracted for it in this (the Northern and Midlands) part of the country. On this particular question, a colliery that had been communicated with wrote: "The position is serious in the extreme. It will be impossible for us to hold to our contracts." Another replied: "Our decrease is owing to the enlistment of men, and the bad service given by the railway authorities owing to the shortage of waggons." Another important matter had a great bearing upon their present-day difficulties, and that was, he regretted to say, the way in which the question of coal shortage had been taken up by some newspapers. It had certainly not been handled in a way that had helped them. He understood the function of a newspaper was to give a correct report of what had *taken* place, but some newspapers to-day were not content with that, but anticipated what was *going* to take place. He regretted to say that several important newspapers had "investigated" the matter of coal shortage on their own account, for they had already interviewed miners' representatives in regard to what they thought about the situation and the Eight Hours' Act. He ventured to think that some newspapers had not interpreted the matter at all properly. It was not right that they should publish news based on insufficient grounds and bad information—such action had rather hindered them in their negotiations. The declaration of the Executive Committee of the Miners' Federation in London the previous Tuesday respecting the suspension of the Eight Hours' Act might not have been due to what had appeared in the newspapers referred to. At the meeting a statement issued at the close declared that they "emphatically protested against the movement at present being engineered by certain mineowners, manufacturers, gas companies, and others in various parts of the country to bring about a suspension of the Eight Hours' Act." "Mr. Chairman," proceeded the speaker, "we as gas undertakings are not tied hand and foot to the suspension of the Miners' Eight Hours' Act. If we can get the coal we want, no suspension of the Act is necessary." [Hear, hear.] The protest referred to clearly stated that the "shortage in the supply of coal was not in any way due to the operation of the Eight Hours' Act." While they were told, on the one hand, that the coal shortage was attributed to the large number of miners who had left their work and gone to the defence of their country and risking their lives on the field of battle, it was also the fact that many of the remaining men were not, as already pointed out, working full time owing to shortage of railway waggons. After a brief reference to the position of the Durham miners, Alderman Phillips went on to say that he sincerely hoped at no period or time would they find the members of the gas profession in a spirit of opposition either to the miners or to their leaders, but rather, as Macaulay had well said,

"Then none were for a party
And all were for the State,

they would find themselves working in close co-operation together. Miners' leaders, he hoped, would be heard to say to their men: "Now chaps, a good many of our men have gone away. We want you to keep your end up and let the interests of the country go on, in order to support your mates at the front. Put your shoulders to the wheel, and, if possible, do a little bit more." Alderman Phillips went on to say that if this appeal were made by the men's leaders, he felt it would be responded to as nobly by the men at home as by the men who had joined the Colours. He wanted, above everything, to say that they as gas producers were against the suspension of the Eight Hours' Act. If any other course could be found, let it be found; but it appeared to him that if a miner went down the pit at six o'clock in the morning, and he had to be at the top again at two o'clock, the pit was not working for sixteen hours out of the twenty-four. If for a period of time the men were willing to come to an agreement with the coal-owners to work extended hours, the increase in the coal supply would be very considerably increased, and all their difficulties would vanish. This was what he thought they were entitled to represent to those at the head of affairs in the country, and therefore he had pleasure in moving the following resolution:—

That this conference of gas authorities of England and Wales, having considered the situation with regard to the totally inadequate supplies of coal now available, is of opinion that urgent representations should be made to the Prime Minister, pointing out the seriousness of the position, and asking him to take immediate steps to increase the present output of coal, and the provision of greater facilities for railway transport in any manner that may be practicable.

They were not, he added, wedded to the suspension of the Miners' Eight Hours' Act if another way could be found to relieve the difficulty and serve their purpose. There was a provision in clause 4 of the Eight Hours' Act under which the Government could take action. The clause referred to was in the following terms:

His Majesty may, in the event of war, or of imminent national danger or great emergency, or in the event of any grave economic disturbance, due to the demand for coal exceeding the supply at the time, by Order in Council suspend the operation of this Act to such an extent and for such period as may be named in the Order, either as respects all coal mines or any class of coal mines.

He had endeavoured to show them the necessity for a remedy, and to recommend for their consideration the question of approaching the head of the Government so as to point out their difficulties.

Round Table Conference Suggested.

Mr. Kay said they were indebted to Alderman Phillips for a very explicit definition of the position in which they found themselves, and for the admirable manner in which he had put the resolution to them. He had before him a pile of correspondence exactly on the same lines as read out by that gentleman. He had great pleasure in seconding the resolution, and called upon Captain R. S. Hilton, of Birmingham, to speak to it.

Captain Hilton said he was quite in favour of joint action being taken by the gas undertakings of the country to lay before the Government the state of things which existed that day and the position in which they found themselves. It was, of course, obvious that the suspension of the Eight Hours' Act would increase the output of coal. He heartily concurred with everything Alderman Phillips had said. He believed that if the Government were approached with the idea of calling a round-table conference of coal-owners, railway authorities, trades' union representatives, and large manufacturers, some arrangement might be arrived at by which the present output could be increased.

The resolution was then put and carried unanimously.

Members of the Deputation.

Alderman Armitage, the Chairman of the Doncaster Corporation Gas Department, expressed his satisfaction that the resolution had been passed unanimously. He had pleasure in moving a further one, as follows:

That a deputation consisting of representatives of the following gas authorities be now appointed to seek an interview with the Prime Minister, in order to lay the matter before him—viz., Manchester, Salford, Birmingham, Nottingham, Bradford, and Leicester.

He hoped and trusted that much good would be accomplished as the result of the convening of the meeting.

Alderman H. Wilde, the Chairman of the Oldham Corporation Gas Department, said he had much pleasure in seconding the resolution. He felt that they wanted all the sympathy of the miners at the present time. They knew, too, how every man was rising to the difficulties of the existing situation; and he therefore felt that if they could only approach the Miners' Federation in the proper spirit, they, too, would appreciate it in that spirit, and they would overcome their difficulties.

Mr. S. Glover, of St. Helens, asked whether it was intended at this meeting to suggest what gentlemen should represent the districts concerned.

Mr. Kay said he thought he might venture to answer this question off the reel. His idea was that they should be asked to nominate two of their own representatives—for instance, the Chairman of the department and the Engineer or Manager.

The resolution was passed unanimously.

The Question of Toluol.

The Chairman said he had pleasure in calling on Mr. Macintosh Williams to address them on a most important subject.

Mr. Macintosh Williams, of London, said he came before them that day on behalf of the War Office Committee on the Supply of High Explosives, whose Chairman was Lord Moulton.

At the start of the war, the Government recognized that it was necessary for the satisfactory conclusion of it that they should have all the supplies of toluol which were available in the country. They first approached the tar distillers and made satisfactory arrangements with them. Then they approached the coke-oven manufacturers, and got what they had to give. But owing to the demands of the Allies they found they were still short; and therefore they had now to appeal to the patriotism of the larger gas undertakings that they would make arrangements to wash the toluol contents out of their gas, and, in case of need, replace the toluol contents with benzol if it was found necessary to preserve the illuminating and the calorific power. The War Office proposed, at first, to seek the assistance of those gentlemen who were carbonizing 80,000 or 90,000 tons of coal per annum. The Government suggested that they should supply the plant, and pay for the cost of erection and all expenses in connection with it. The Government did not ask them to work for nothing, but at the same time they thought a large profit should not be made, seeing that the matter was one of national necessity. They suggested that a small percentage on the working expenses connected with extracting the toluol should form the profit. To induce them to give them as much toluol as possible, the Government suggested that their profit should increase in proportion to the percentage of toluol they supplied, having regard to the total percentage of toluol which might exist in their particular gas. The Government proposed a minimum of 5 per cent. on the working expenses for up to 70 per cent. of the total toluol contents, and a further 2½ per cent. on the working expenses for each 5 per cent. additional; so that they could make 20 per cent. on their working expenses. The general idea was that they would be able to get out, possibly, 80 per cent., and have a profit of 10 per cent. The Birmingham Corporation had made some experiments already with regard to the matter, and they were still going into it and continuing their experiments. The results of these experiments were open for any of those now present who were willing to take the matter up for the Government. They thought that if the wash-oil employed for washing or scrubbing the gas was first of all pre-benzolized, then the wash-oil would only take up the toluol contents of the gas and leave the benzol contents of the gas to a certain extent intact. Birmingham had made some experiments, and they found that if the oil was pre-benzolized to the extent of 5 per cent., it was possible to extract nearly 80 per cent. of the toluol contents, and leave over two-thirds of the benzol contents still in the gas. If this was the case, then it materially assisted the Government in the "job" they had in hand. Dr. Davidson, of Birmingham, had drawn up a rough sketch of the plant which he thought might be adopted. This plant was open to change to any of them who had any suggestions to make. It was simply put forward as of assistance to show the lines upon which they thought the thing should be done. It was essential that the work should be done as quickly as possible. Therefore if they had plant available, like spare washers or scrubbers, or spare tanks, the Government suggested that the value which they ascribed to such spare plant in their books should be taken, and that the Government should pay them 5 per cent. on the value. Then at the end of the war the plant which they had lent to the Government should be re-valued, and the Government should pay them the difference between the first and second valuation.

Thanks to Councillor Kay.

Mr. R. Watson, of Doncaster, in proposing a hearty vote of thanks to Mr. Kay for presiding over their deliberations, suggested that a copy of the resolution they had passed should be sent to the Gas Companies' Protection Association. He also proposed that their hearty thanks be tendered to the Lord Mayor in welcoming them at the initial stage of the proceedings, and for lending his Parlour for the meeting.

Mr. Chas. Wood, of Bradford, seconded the motion, and it was cordially agreed to.

Mr. Kay, briefly replying, said no thanks were due to him for doing his duty. He assured them that both Alderman Phillips and he were always anxious to further the interests of the undertakings with which they were connected. He would take care that their thanks were conveyed to the Lord Mayor for presiding earlier in the proceedings.

THE GAS INDUSTRY AND THE WAR.

Captain R. S. Hilton, the Secretary and Manager of the Birmingham Corporation Gas Department, who has been serving with the 1st City Battalion, is temporarily transferred by the War Office to assist Lord Moulton on the High Explosives Committee.

Mr. W. J. Liberty (Inspector of Public Lighting of the City of London), who, at the commencement of the war, joined the Royal Naval Reserve Volunteer Anti-Air Craft Corps, has now been transferred from the Reserve to the Royal Naval Air Service (armoured car section) for "special service" on the East Coast. Mr. Liberty is at present serving at the Admiralty Headquarters of the Royal Naval Air Service at Newmarket. Previously, he was a Member of the City of London Artillery Corps.

It is mentioned in the "Co-Partnership Journal" of the South Metropolitan Gas Company for the current month that Mr. Alfred Wright, who six years ago was a fitter's mate at the Clapham depôt, and who left the Company's service to enlist in the 21st Lancers (Empress of India's Own), has been promoted to a lieutenancy in the Border Regiment at Calcutta. He has been in India for four years, and his promotion to a commission in so short a time is an achievement upon which he is to be warmly congratulated. His father, Mr. H. Wright, is a corporal in the 24th Company of the National Territorial Reserves.

The Berlin firm of "Julius Pintsch," makers of gas-plant, &c., is reported in the "Journal für Gasbeleuchtung" for the 23rd ult. to have had between 400 and 500 of its employees called to the colours at the outbreak of the war. The ordinary business of the firm has been greatly interfered with; but the works have been busily engaged on war contracts, and the administration sees no reason for dissatisfaction with the position of the Company. Business with neutral countries has, however, become very slack. In regard to the affiliated companies, the administration understands from the latest reports which have reached it, that the English factory is continuing at work, while the French factory has been converted into a hospital. It is anticipated that debts from enemy countries will be collected at the conclusion of the war; but it is impossible, they say, to predict what result the next business year will bring forth.

Alderman Sir Hallewell Rogers (the Chairman of the Birmingham Gas Committee), in the course of an interview, informed a representative of the "Birmingham Daily Post" that no shortage of coal has been experienced by the department at present, and no anxiety is felt as to the immediate future. Since the coal strike in August, 1911, the policy of the department has been to keep a very large stock; and that now in hand is much larger than has ever been held before. Owing to the congestion on the railways, the scarcity of labour, and the shortage of trucks, coal is not arriving in the usual quantities; but no serious trouble in securing supplies has as yet been experienced. Even should the supply cease altogether, the present stock is sufficiently large to tide the department over many months. It is anticipated that one result of the difficulty householders have in securing supplies of coal will be to largely increase the use of gas-fires. In fact, already the department have out a great many more than has ever before been the case. The coal used by the department comes mainly from the Derbyshire and North Staffordshire pits, while some is supplied from Yorkshire. The greatest distance over which it has to be transported is about 70 miles. The Electricity Department stands in a different position, as plentiful supplies of suitable coal for fuel purposes are to be obtained from the local pits.

Some reference to the effect of the war on the aniline dye industry was made at a meeting of the Drapers' Chamber of Trade. One member stated that whereas at the beginning of the season they were accustomed to have 500 colours brought before them, this year only 24 colours had been submitted, and the fastness of the dyes was not guaranteed. The urgent necessity of the Chamber exercising its influence on the industry was pointed out by the retiring President (Sir Jon Prichard-Jones), who said that 80 per cent. of the dyes used annually in this country had been coming from Germany.

Replying to questions in the House of Commons last Thursday, Mr. M'Kenna said the Government were giving careful consideration to the question of the advisability of suspending the operation of the Coal Mines Regulation Act, so that miners might not be prevented from working more than eight hours per day under the powers conferred by section 4 of the Act in the event of war, of imminent national danger, or great emergency, or in the event of any grave economic disturbance due to the demand for coal exceeding the supply. He could not, however, make any statement on the subject. In a matter of this kind, he thought both employers and men ought to be consulted before any action was taken. He had seen the statement that the Miners' Federation of Great Britain had protested against the section being put into operation.

It will be seen from our "Notes from Scotland" that the decision come to by the Gas Committee of the Dundee Corporation to take part in a deputation to the Government on the question of the suspension of the Eight-Hour Act for Miners, to which reference was made last week, did not receive the approval of the Town Council at their meeting on Thursday; and the subject was, by a small majority, remitted back to the Committee for further consideration. This decision is to be regretted, as it means a delay of two months, when prompt and united action was called for. The other authorities concerned will, however, no doubt carry out their original intention.

At a meeting of the Clapham Chamber of Commerce on Friday, the Secretary (Mr. J. R. Pickering) announced that the South

Metropolitan Gas Company had sent in a charge for high-pressure gas-lamps, which they said covered a portion of the cost of maintenance. At Balham, at the outset, active steps were taken by the Traders' Association; the majority of the members holding that no charge at all should be made. It was finally agreed that the charge for the Christmas quarter should remain as it was, but that after that it should be reduced 50 per cent. It was a ticklish point as to who was responsible—the Company or the consumer. The Chairman (Mr. C. S. Gulliford) said he had considerable experience of the South Metropolitan Gas Company, and they were one of the most enterprising gas companies in London, if not in England. [A member: And one of the most fair dealing.] Yes, he agreed—one of the most fair dealing. ["Hear, hear."] He had met inspectors of the Company at council committee meetings, and had always found them exceedingly obliging and ready to do anything in their power. In the matter under discussion, there was a lot to be said for the Company. With regard to their extra charges for supplies for ordinary purposes, they were not to blame, but the shipowners, who ought to be "shown up." Our Navy, for which they all had to pay, was keeping the seas clear for British pirates—that was not too strong language for them—to carry on their nefarious business. The Chamber ought to strengthen the hands of the Company by sending a petition to the Government asking that the matter be remedied. Mr. Moody said he raised no objection to paying the charges of the Company, as he considered them fair. No one could foresee the war; and now everybody ought to be ready to help to bear the inevitable burdens. They should meet the Company in a fair spirit, for they were evidently making a great loss.

The matter was also discussed at a meeting of the Battersea and Clapham Junction Traders' Association, when a letter was read from the South Metropolitan Gas Company, embodying terms for the hire and maintenance of the high-pressure gas-lamps. Mr. Jacobs stated that the effect was that a 1000-candle power gas-lamp, which before the war cost £1 3s. 9d. per quarter for hire and upkeep, would now cost 3s. 7d. while the police regulations remained in force. It was agreed to write thanking the Company for their consideration. Mr. Roche drew attention to the circular of the Company with regard to the danger of an increase in the price of gas by 6d. or 8d. per 1000 cubic feet. The Company could not get coal shipped from Newcastle except at exorbitant freight rates. He believed there was no shortage of coal. It was a matter of importance to shopkeepers; and he proposed that they write urging the Government to take immediate action. This was adopted.

The Hendon District Council have accepted the offer (without prejudice) of the Gas Light and Coke Company to make an allowance of £37 17s. in respect of lamps out of lighting. The Tottenham District Light, &c., Company have advised the Southgate Urban District Council of their inability to make any reduction in the amount chargeable to the Council under the street lighting contract for the last quarter. The Clerk has been directed to communicate with other councils served by the Company, in order to ascertain the views of those councils on the Company's charges, and also to ascertain the action taken by several of the large gas companies in London.

Arrangements are being made by the Town Clerk and the police with the authorities of towns in the vicinity of the East Coast with a view to acquainting Nottingham in the event of hostile air-craft being observed travelling in the direction of the city. If such an alarm be given, the Nottingham authorities will lose no time in warning the inhabitants of the district by the sounding of the hooters and sirens for an interrupted period of not less than five minutes. At the expiration of ten minutes after the warning has been given, the city's supply of gas will be turned off, in order to reduce to the minimum any attraction to the enemy in the way of street lights, and to prevent the situation of the city and the architectural beauties being discovered. Householders and business people are asked to see, should the gas be turned off, that the taps at their meters and on the system of pipes throughout their dwellings or premises are effectively turned off, in order that no danger may be caused when the supply from the mains is renewed. The supply of electricity is not to be cut off. Most of Nottingham's public institutions and places of amusement are lighted by this means; and it is felt that it would not be advisable to plunge them suddenly into darkness. The users of this means of illumination are asked to shut off their lights as soon as possible after the hooters have sounded.

Consequent upon the receipt of a letter from the Lord-Lieutenant suggesting precautions in case of raids by the enemy, it was stated at the last meeting of the Torquay Town Council that the Town Clerk had been directed to so arrange that, upon a given signal, the managers of the Corporation electricity works, of the gas-works at St. Mary Church, and of the Torquay Gas Company should be prepared to cut off the gas and electric current from the mains.

In conducting the lighting arrangements of their premises during the next little while, eighteen of the residents of Southend and Westcliffe will do well to take as their motto the name of Captain Dimmer, V.C., the Brigade Major, to whose tour of inspection (in company with a police sergeant) on a previous evening they owed their appearance at the Borough Police Court, on a charge of failing to obey an order made under the Defence of the Realm Act, for the restriction of the lighting. It was stated that the order was made by the General Commanding at Chatham, who had telegraphed that it was most important it should be carried out. After a serious warning by the Mayor, all the summonses were withdrawn. During the evening when the offenders were brought to book, as the authorities considered the order was not being sufficiently complied with, the electric light was switched off for over half-an-hour, which, of course, inflicted inconvenience on the law-abiding and the transgressors alike. Several shops were ordered to be closed between 5 p.m. and 7.30 a.m. for non-compliance with the regulations.

The Home Office Order dated Nov. 16, imposing restrictions on street lighting and external shop-lights in Birmingham, has been withdrawn; and there has been substituted for it a more drastic one, requiring further reductions. Accompanying the first order was a memorandum informing the Chief Constable that the Admiralty advised that preparations should be made so that in case of emergency a more general reduction of lighting could be enforced, on the lines adopted in London. The new Order, which includes some of the London regulations, is as follows:—

1.—All sky-signs and conspicuous illuminated lettering and external lights of all descriptions used for advertising or the illumination of shop-fronts shall be extinguished.

2.—The public lighting of the city shall be reduced to the minimum consistent with public safety, and all lights which are not extinguished shall be shaded or obscured so as to render them invisible from above, and to cut off direct light from the lamp in all directions above the horizontal.

3.—The intensity of the inside lighting of shop-fronts shall be reduced, and all bright internal lights in any other premises shall be shaded, so that no bright light is shed outside.

4.—All large lighted roof areas shall be covered over or obscured, or the lighting intensity reduced to the minimum possible. In tall buildings which are illuminated at night, the greater part of the windows must be shrouded.

5.—The use of powerful lights on motor-cars or other vehicles is prohibited.

6.—Any person who shall cause or permit any vehicle, during the period between one hour after sunset and one hour before sunrise, to travel in any street, highway, or road to which the public have access, shall provide such vehicle with a lamp or lamps, in proper working order, and so constructed and capable of being so attached as when lighted to display to the rear a red light visible for a reasonable distance; and every person driving, or being in charge of, any such vehicle during such period as aforesaid shall keep such lamp or lamps properly trimmed, lighted, and attached. For the purpose of this Order the word "vehicle" shall include any bicycle, tricycle, or velocipede, and any vehicle drawn or propelled by hand.

7.—The lights of tramcars and omnibuses must not be more than is sufficient to enable fares to be collected.

8.—The intensity of the lighting of railways, sidings, and goods yards must be reduced to the minimum that will suffice for the safe conduct of business there. The upper half of the globes of all arc lights must be shaded or painted over.

9.—The aggregation of flares in street markets or elsewhere is prohibited.

10.—In case of sudden emergency, all instructions given by the military or police authorities as to the further reduction or extinction of lights shall be immediately obeyed.

The new Order is now in operation, and applies to the period from one hour after sunset till one hour before sunrise.

At a special meeting of the Burton-on-Trent Gas and Electricity Committee, the Chairman (Alderman T. E. Lowe) referred to the question of taking precautions in case of a possible air-raid, particularly so far as regards reducing the lighting of streets and shop-fronts. After discussion, the Committee unanimously decided that, for the present, the whole of the street lighting should be reduced by one-half; and that lamps in the streets, notwithstanding the reduction in the amount of lighting, should be shaded so as to prevent any light being seen above the horizontal. The Committee also strongly urged tradesmen to dispense altogether with outside shop lighting.

The Nantwich Urban District Council recently sought the advice of the Local Government Board in regard to their position with respect to an application from the Red Cross Society for relief from rates and for a supply of gas free for a hospital. The Board have informed the Council that if the premises were in the occupation of the Government, no rates could be levied thereon; otherwise they were not aware of any authority exempting the premises from the payment of rates, or entitling the Council to grant a free supply of gas. If in any cases the charges were not collected, the matter would come before the District Auditor, and he, no doubt, would consider any exceptional circumstance when dealing with the accounts. The Board could not express any opinion as to what course they would take in the event of a surcharge being made by the District Auditor.

The employees of the Kidderminster Gas Company (works department) have been making weekly collections in aid of the Prince of Wales's Fund. Up to New Year's Eve, they had subscribed £12 10s. 3d., which has been sent periodically to Buckingham Palace.

THE QUALITY OF LONDON GAS

In the Year 1914.

We give below a summary, in the customary form, of the results of the official testings of the gas supplied by the three Metropolitan Companies during the fourth quarter of 1914, and a further summary for the complete year. The corresponding summaries for the fourth quarter of 1913 and for the year 1913 appeared in the "Journal," Vol. CXXV., p. 146, and detailed separate statements for the first three quarters of 1914 appeared in Vols. CXXVI. (p. 493), CXXVII. (p. 279), and CXXVIII. (p. 121). The results given refer to the testings made in the nineteen testing places which are under the control of the London County Council, and the summaries have been prepared from the reports issued by that body. These reports were issued weekly up to and including the week ending the 31st of October last, since which date they have been issued only once a month. Since the 31st of October last, therefore, less information is available as to the number of low or high returns made in a given period. But the averages are, of course, unaffected by the new arrangement.

FOURTH QUARTER OF 1914.

Illuminating Power.

The average results of the testings of illuminating power made both with the standard argand (No. 2 "Metropolitan") burner, and the prescribed flat-flame burner, on the gas supplied by the three Companies, are given for this quarter in Table I. The figures for the corresponding quarters of 1912 and 1913 are also given in the table by way of comparison.

Table I.—*Averages of All the Testings of Illuminating Power for the Fourth Quarter of the Year* [*Candles*].

Company.	No 2 "Metropolitan" Argand.			Flat-Flame.		
	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke.	14·47	14·43	14·22	8·17	8·15	7·78
South Metropolitan.	15·52	15·57	15·10	9·44	9·42	8·76
Commercial . . .	14·88	14·46	14·35	8·36	7·66	7·89

The figures show that there has been a sensible drop in the average illuminating power in the case of all three Companies, as shown by the results of the argand testings. The average is in all cases well above the prescribed standard of 14 candles.

The minimum returns for the argand testings on the Gas Light and Coke Company's supply were: During October 13·27, during November 13·12, during December 12·42 candles. The weekly returns for October disclosed that in two weeks other than the one in which the minimum of 13·27 was reported, there were also returns below 13·5 candles. Since the Company were liable, according to the Acts in force up to the end of the year, to incur forfeitures in respect of returns which gave an average on three consecutive days' testings below 13·5 candles, it is possible that the Company may in fact have become liable to forfeitures in respect of the months of October and November; but the published figures do not present sufficient detail for a conclusion to be drawn on this point. Since, however, the Company are liable to a forfeiture in respect of a single day's testings if the result is below 13 candles, it would appear that in the month of December they will have become liable to forfeiture unless they are able to satisfy the Chief Gas Examiner that there was some unavoidable cause to account for the deficiency. Having regard to the difficulties of coal supply at the present time, the Company should have no difficulty in convincing the Chief Gas Examiner that the deficiencies in December were excusable.

The minimum return for the argand testings on the South Metropolitan Gas Company's supply was 13 86, which occurred in the month of December. In October and November there were no returns below 14 candles, The minimum returns for the Commercial Gas Company were: In October 13·74 candles, in November 13·65, in December 13·69. Hence neither the South Metropolitan nor the Commercial Company had any returns last quarter below the permissible limit of 13·5 candles.

The minimum returns reported for the flat-flame testings made during the quarter were: For the Gas Light and Coke Company, 5·81 candles; for the South Metropolitan Gas Company, 7·72 candles; for the Commercial Cas Company, 6·74 candles.

Calorific Power.

Table II. gives the average of the results and the maximum and minimum figures reported for the testings of calorific power during the quarter and corresponding quarters of 1912 and 1913. Like the corresponding figures for illuminating power, these returns for calorific power show that there has been appreciable reduction in the quality of the gas compared with the corresponding quarters of the two previous years. The minimum figures reported for the Gas Light and Coke Company and the South Metropolitan Gas Company are above the standard of 112·5 calories net to which the gas of the former Company was required to conform on the average of three consecutive days' testings by the Company's Act of 1909. The Commercial Gas Company who, like the South Metropolitan, are under no statutory obligation in respect of the calorific power of the gas they supply had a minimum return—viz., 111·6 calories—below the three days' standard of the Gas Light and Coke Company. The Gas Light and Coke Company's Act of last year, which came into force on the 1st ult., makes the Company liable to incur a forfeiture in respect of deficiency of calorific power if the result of the testings on a single day falls below 499·5 B.Th.U. gross. It is interesting to observe that in the last quarter of 1914 there were minimum returns of gross calorific power in the case of both the Gas Light and Coke Company and the Commercial Gas Company which were slightly below this standard. The gas supplied by the South Metropolitan Gas Company was well above this standard throughout the quarter.

Table II.—*Summary of Testings of Calorific Power (Gross and Net) for the Fourth Quarter of the Year* [*Calories per Cubic Foot*].

Company.	Average.			Maximum.			Minimum.		
	1912.	1913.	1914.	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke—									
Gross	136·1	136·5	134·5	145·9	161·6	143·0	128·7	128·1	125·3
Net	121·2	121·7	120·0	129·1	146·0	128·2	113·6	113 8	112·8
South Metropolitan—									
Gross	144·3	144·2	139·2	163·4	160·2	152·2	133·2	133·9	131·7
Net	128·5	128·3	123·7	145 8	143·4	135·6	118·4	118·8	116·3
Commercial—									
Gross	136·2	136·2	134·3	151·4	144·8	147·8	126·3	126·1	123·6
Net	121·9	121·8	120·2	136·5	130·8	133·8	112·2	111·4	111·6

Sulphur.

The average and maximum figures for the testings for sulphur during the fourth quarters of 1914 and the two preceding years are given in Table III.

Table III.—*Summary of Testings of the Sulphur in London Gas for the Fourth Quarter of the Year* [*Grains per 100 Cubic Feet*].

Company.	Average.			Maximum.		
	1912	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke.	36·4	34·4	35·7	63·2	55·5	55·7
South Metropolitan	26·2	25·1	18 1	55·5	65·8	60·8
Commercial . . .	28·8	28·5	29 8	47·5	47·3	44·0

The figures for the Gas Light and Coke Company and the Commercial Gas Company do not call for any comment; but there is a very marked reduction in the proportion of sulphur in the South Metropolitan Company's gas, due clearly to the extension by the Company of the catalytic method of purification.

RESULTS FOR THE COMPLETE YEAR.

Illuminating Power.

Table IV. summarizes the results of the testings of illuminating power for the complete year and for the two preceding years. The averages for 1914 are slightly below those for either of the two previous years in the case of all three Companies.

Table IV.—*Averages of All the Testings of Illuminating Power for the Whole Year* [*Candles*].

Company.	No. 2 "Metropolitan" Argand.			Flat-Flame.		
	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke.	14·52	14·40	14·32	8·25	8·18	7·89
South Metropolitan	15·49	15·51	15·31	9·38	9·44	9·07
Commercial . . .	14·89	14 61	14·40	8·43	8·22	7·78

The minimum returns for the argand testings throughout the year were: For the Gas Light and Coke Company, 12·42 candles (in the fourth quarter); for the South Metropolitan Gas Company, 13 79 candles (in the first quarter); for the Commercial Gas Company, 12·89 candles (in the third quarter). The minimum flat-flame returns were: For the Gas Light and Coke Company, 5·72 candles (in the second quarter); for the South Metropolitan Gas Company, 7·07 (in the third quarter); for the Commercial Gas Company, 5·85 candles (in the third quarter). The maximum returns for the argand testings for the whole year were: For the Gas Light and Coke Company, 16·07 candles; for the South Metropolitan Gas Company, 17·95 candles; for the Commercial Gas Company, 16·05 candles. All these returns were in the first quarter of the year.

Calorific Power.

The results of the testings of calorific power during 1914 and the two preceding years are summarized in Table V.

There is a perceptible reduction in the average calorific power of the gas supplied, as compared with the two preceding years in

TABLE V.—*Summary of Testings of Calorific Value (Gross and Net) for the Whole Year [Calories per Cubic Foot].*

Company.	Average.			Maximum.			Minimum.		
	1912.	1913.	1914.	1912.	1913	1914.	1912.	1913.	1914.
Gas Light and Coke—									
Gross	135·3	136·1	134·9	148·6	161·6	148·8	123·7	126·6	121·7
Net	120·6	121·2	120·4	132·8	146·0	134·1	110·2	113·3	109·8
South Metropolitan—									
Gross	143·4	143·9	140·6	163·4	160·2	157·1	131·7	133·9	127·9
Net	127·7	128·1	125·1	145·8	143·4	140 0	116·6	118·8	114·5
Commercial—									
Gross	136·2	135·3	134·2	151·4	147·3	147·8	122·0	123·1	120·8
Net	122·0	121·1	120·2	136·5	132·7	133·8	112·0	110·7	108·7

the case of all the Companies. The minimum return in the case of the South Metropolitan Gas Company is well above accepted standards; but the minimum returns for the other two Companies are below the standards prescribed in the Gas Light and Coke Company's Acts either of 1909 or 1914.

SULPHUR.

Sulphuretted hydrogen has been absent throughout the year from the gas supplied by all three Companies. The average and minimum results of the testings for sulphur in other forms in 1914 and the two preceding years are shown in Table VI.

TABLE VI.—*Summary of Testings of the Sulphur in London Gas for the Whole Year [Grains per 100 Cubic Feet].*

Company.	Average.			Maximum.		
	1912.	1913.	1914.	1912.	1913.	1914.
Gas Light and Coke.	34·8	35·7	33·6	63·2	62·2	55·7
South Metropolitan.	24·5	24·1	18·5	55·5	65·8	60·8
Commercial . . .	27·5	28·7	30·3	47·5	54·7	67·9

Here again the outstanding feature of the returns is the large reduction in the average proportion of sulphur in the gas supplied by the South Metropolitan Company.

PRESSURE.

No observations of pressure have been reported in the published returns of the London County Council throughout the past year.

ELECTRICITY SUPPLY MEMORANDA.

MANY local authorities in London and the region surrounding are to-day exceeding glad over the kindly disaster that befel the London County Council Electricity Bill, at the meeting of that august body last Tuesday. On that day, there came up for confirmation the resolution passed on Nov. 10 last by which the Council determined to proceed with the Bill for carrying out a huge experiment on London with a Company-Council controlled electricity scheme, in which were to be concentrated the whole of the electricity services not only of London, but of much area beyond. It was necessary that the confirmatory resolution should be carried by an absolute two-thirds majority of the Council; but as there are some fourteen Municipal Reformers serving with the Colours, five on the sick-list, and one on circuit, the two-thirds majority was not secured, and so the Bill apparently succumbed. The result may be indirectly attributed to the war; and even this fact will not raise sympathy for the promoters, seeing that they were earnestly appealed to not to proceed with the Bill until the end of the war. The appeal fell on deaf ears, the owners of which appeared to think they had some strategic advantage in hustling forward. However, the claims of the war have, it is hoped, compelled the delay which they declined to grant. If so, this will give additional breathing-time for the complete consideration of the scheme by all concerned. So far as the authorities outside the Council had considered it, they could see nothing that was good about it; and they had formulated strong opposition cases. If the Council have the temerity to again bring the scheme forward next autumn (if for the present Bill they cannot obtain a revision of the vote of last Tuesday, as it is hoped to do) for promotion in the 1916 session of Parliament, the hostile army will have had ample time to make out a still more concrete case, and the extra time is just what the promoters of the scheme did not want them to have. However, if the scheme is unfortunately proceeded with this year or is revived next year—there has been a lot of money wasted over it so far—the Council may anticipate that they will have the time of their lives in the Parliamentary Committee rooms.

Defeat of the L.C.C. Bill.

From the Opposition Side.

The many authorities outside London, the Borough Councils in London, and the Electricity Companies in the area, were practically all antagonistic; and we know that the Gas Companies would have entered an appearance against the measure. The Borough Councils owning electricity undertakings, in a joint report on the subject, made many contentions. Among them they held that the present authorized distributors were quite capable of rendering still greater public service in the future than they had done in the past; and that there was nothing in the scheme that would be beneficial to the ratepayers. In fact, they feared for the financial issues of the scheme; and they were confident it was not right, in the matter of generating plant concentration, to keep such large eggs in one or two baskets. They saw a millstone of debt—counted by millions—coming upon the ratepayers of London, through the scrapping and unifying process, and plant concentration at a couple of stations, to say nothing of the dearness of money in the immediate future and some way ahead. The Electricity Companies were bound to oppose; and ten of them are left in possession of the field (assuming there is not a reversal of last Tuesday's vote) with their alternative scheme, against which the County Council and most of the local authorities owning electricity works are going to operate, if the measure ever goes forward. A great commendation about the scheme is that the County Council project admitted the superiority of the company brand of management, by proposing to put a company into possession of their own scheme for a long period. No doubt if the companies proceed, they will make much of this point. Then there are the Gas Companies. The Directors of the South Metropolitan Company, in their half-yearly report, expressed aversion to both Bills, as they contain proposals to place on the ratepayers of London the burden of providing for deficiencies arising out of the non-remunerative sale of electricity. "London's gas supply," it was added, "has attained its present efficiency without aid from the rates, and the various electrical undertakings have been sufficiently long established to be run on their merits, without being subsidized to meet competition." At the meeting of the Commercial Gas Company on Thursday, the Chairman (Mr. W. G. Bradshaw) showed that the London Gas Companies were determined to resist to the utmost this proposed subsidizing. The electricity supply undertakings are usually the pampered favourites of our local governors, who cannot rid themselves of the idea that electricity is still in its infancy, and so must need still be kept in leading-strings and under external financial protection. It is time that Parliament altered this, and placed municipal trading on the same basis as company trading—let it rise on its own merits, or else collapse on its own demerits, without, in the event of failure, penalizing a lot of people who have had no part in producing the failure.

Assured Success, Yet Provision for Failure.

It shows a curious twist in reasoning when, in a scheme of this kind, it is considered necessary to make provision for recourse to the rates while all concerned in the promotion are so confident of success—a dual success in the way of cheap electricity and large profits. The confidence that has been expressed over this now temporarily defunct scheme of the County Council has been of the magnificent order. Everything was coming out right, even to the realization of surplus profits to be devoted to the relief of the rates, instead of the rates having to go to the relief of the undertaking. Nevertheless, there was the provision for making the ratepayers furnish supplies for meeting deficiencies. Those people who want to see schemes of this kind go through, and who express such immense confidence in them, do not seem to be capable of recognizing the fact that these are not days when miracles are going to happen in connection with the commercial supply of electricity. Their idea obviously is that it is only necessary to draw up an electrical scheme on paper—in this London case a scheme without parallel—for it to work out in every detail according to prediction. But history, which repeats itself in connection with electricity supply, tells us that it is against all electrical custom for any electricity scheme to faithfully comply with estimates. However, the County Council project has, it is hoped, gone for a period, if not for ever. People other than the Council do not want a contest over it during this year of great national anxiety and tension; nor do they desire to see any immediate spending of dear money over something that is not necessary. It is just as well that the vote was an adverse one last Tuesday; for, if not altered, it will allow more light to emerge from the present condition of national affairs before doing anything further with this money-absorbing electrical proposal. London has not, on the whole, done badly up to the present over a fairly low-priced electricity supply; and London can wait a little longer before entering upon the discussion of revolutionizing the electricity supply systems of such a large area as the one proposed. The only people who may regret the inability of the Municipal Reformers to scrape together the necessary majority last Tuesday have addresses Westminster way.

Illegality and Surcharge.

"Electrical Engineering" has published a notice of the result of the Ilford case, and has interlarded it with comment, and finished it off with a little homily on the subject of the folly of devoting time to the framing of tariffs "asymptotic" to the border-line which divides preferential charging from allowable tariffs. It happens that in the Long Eaton, Ilford, and certain other cases, the tariffs were not only asymptotic to the said border-line, but they actually crossed it to the wrong side. There is good authority for this, which authority rather annihilates the terrible-looking word which enabled our contem-

porary to advance a little advice to tariff-designers. However, since the Ilford case was before the Court, our contemporary states, the Gas Company have appeared at the annual audit of the District Council's accounts, and have claimed a surcharge of the whole sum expended on hiring and fitting. There was an indication when the matter was before Mr. Justice Sargant that something of the kind might happen, and learned Counsel representing the Council appeared to be rather nervous as to the result. The Court having made declaration that the Council had acted *ultra vires* in this matter, there seems to be no option on the part of the Local Government Board Auditor but to recommend the surcharge, though the Board may (as is pointed out) use their discretionary powers, and remit it. Then our contemporary adds: "If the Council are advised that, under the declaration, they cannot sell the apparatus, and the surcharge is duly made, the only course to be followed is for the apparatus to be handed over to the surcharged councillors, who themselves must sell it, and set off the amount so received against the surcharge." This would be a very troublesome proceeding; but seemingly our contemporary has not given adequate consideration to Mr. Justice Sargant's intimation that, in the circumstances, he should not be prepared to grant an injunction against the Council on the ground that, in adjusting matters, they effected a sale of the existing apparatus on hire to the users. But when people take upon themselves the management of an enterprise such as an electricity concern, and know so little of what their legal powers consist that they exceed them they deserve all the consequent trouble to which they are put.

Domestic Half-Watt Lamps.

An article on electric engineering in the last "Engineering Supplement" of "The Times" contains a reference to the introduction of nitrogen-filled lamps taking only "about" a half-watt per candle power. This lamp is considered to be a "marked advance" in electric lighting. We were not aware that a lamp which is more disastrous to the human vision than anything that has preceded it was a "marked advance;" but the writer of the article in question is of that way of thinking. He also mentions the fact that the so-called "half-watt" lamps have hitherto been made in large units, and that there has been trouble in producing lamps of the same "efficiency" of a size suitable for domestic illumination. Now, however, he asserts that it has been found that by using argon it is possible to make lamps for small candle powers suitable for interior lighting. This is an interesting statement. If true, there has not been noticeable elation over the matter in the electrical papers. Has argon a less cooling effect than nitrogen upon filaments run at high temperatures? The cooling effect of nitrogen has hitherto been found to be so serious that the small filaments requisite for domestic lamp units could not be used; and therefore the production of the lamps was perforce confined to those units which could use larger filaments, upon which the cooling effect was not such a strain. However, the writer of "The Times" article is not altogether confident of success, as he only says: "We thus *appear* to be [not *are*] entering a period similar to that which followed the introduction of the metal filament lamp, when generating plant, cables, &c., were enabled to take on a greatly increased lamp connection."

Science at the Board Table.

The scientific man is at a discount in the electrical industry. It has had too much of him; and, next to legislation, he has been the creator of most of the muddle in which the electricity industry has found itself. It is "Electrical Industries" that has made this discovery. It came to investigate the matter on learning that, according to Professor Meldola's scientific mind, the Government aniline dye scheme is bound to fail because they have not leavened the directorate with scientific men, and science is at the very base of the dye industry. As has been pointed out before in the "JOURNAL," it will be quite easy for the Directors of the new Company to repair the omission by paying good salaries to qualified chemists to help forward the business in some other sphere than the Board room, which is not the place for scientific research. While our contemporary has all possible admiration for the value of science, it holds as a cherished principle that "a chemist at a Board table is as much out of place as a poet in politics." Why this antipathy to the man of science in the Board-room? Because if the history of the electrical industry is surveyed, this is found: "It was the scientific man who gave us the muddle of voltages and periodicities in the supply industry—a veritable curse; it is the scientific man, immersed in technicalities, who has neglected the most obvious means for developing the demand for electricity; it is the scientific man who has made the Institution of Electrical Engineers a debating society *in vacuo*, and through it has discouraged every movement for safeguarding and promoting the basic interests of electrical engineering." This is enough to poison anyone's mind in the electrical industry against Professor Meldola's contention. We have often wondered why things have gone so awry in some quarters of the electrical industry. Now we know.

At the meeting of the Illuminating Engineering Society this day week, a discussion on "The Development and Design of Lighting Fixtures in Relation to Architecture and Interior Decorations" will be opened by Mr. F. W. Thorpe.

THE DISPOSAL OF COKE.—Part II.

AND SOME MEANS FOR INCREASING ITS SALE.

By a Gas Engineer.

IN the last article the advisability of supplying broken coke and coke nuts was strongly urged, as was also the policy of selling these smaller sizes at the lowest possible price above that of ordinary large coke. It was shown that this provision must always widen the local market, especially if fancy prices for the small sizes are strictly barred.

LARGE SCREENED COKE.

As regards the larger sizes, the demand for large coke, 2 inches and over, will always be considerable; but this requirement of coke users is rarely met by the gas undertaking. It may, on the one hand, be argued that it is sufficient to supply large coke, or "unbroken" as it is better termed, ranging in size from small pieces of ½ inch to the full size of (say) 3 or 4 inches. On the other hand, there is more to be said for the policy of screening out all small pieces of coke into their respective hoppers—leaving large pieces only to be sold as "unbroken" coke. In this way a great deal of unnecessary breaking can be avoided, and those customers who require it can be supplied with "large" coke without admixture with a great quantity of small pieces.

If the plant can be arranged to provide coke of 2 inches and over only, and, in addition, coke of all sizes (ranging from small to large) for those who prefer it, so much the better. There are certain industries, and certain uses, too, for which large coke is in great demand; and if in these cases such customers can be supplied exclusively with coke exceeding 2 inches in size, not only is it probable that such custom will be kept permanently, but it will also prove to be profitable in the price paid. When coke-screening plant is designed, it is not difficult to provide that all the coke as it comes from the retort-house is first screened into its respective sizes, and then deposited into overhead hoppers. Then should any particular size be made in quantities exceeding the demand, it should be possible to remove as much as required of this size to its own store to await an increase in the demand. To provide unbroken coke, as frequently supplied forked from a heap, and containing all sizes from (say) ½ inch upwards, it is only necessary to take the required quantity direct from the retort-house to the coke ground and load with forks. But it will be found that customers, so soon as they find that carefully graded sizes can be supplied, will much prefer, in the great majority of cases, some particular grade.

CHOICE OF SIZE.

The different uses for which varying sizes of coke are required depend upon the size of the apparatus in which it will be consumed—the draught, the depth of fuel, and the preference of the user. In all cases it is a question of burning the fuel to give the maximum quantity of carbonic acid in the waste gases. Practice will soon show the best size to use, especially if the gas undertaking takes the initiative of suggesting to the user that in certain cases a different size might suit his purpose to greater advantage. For such attention to be shown it is, of course, essential that the seller should know his customers and the type of apparatus in which the coke will be used. This aspect of the case will be discussed later.

So far as size is concerned, it is well to remember that large apparatus with deep fuel beds invariably requires large coke, and that small apparatus requires broken, or even smaller, coke. If it is necessary to burn the fuel in a thin layer, as for instance in a horizontal steam-boiler, broken coke will be much more suitable, though in some cases large coke can be used. It is obvious that it cannot be right to use large coke where, owing to the thickness of the fuel bed, there can only be two or three pieces between the inlet of the air at the bottom of the grate and the outlet for the products at the top. It is only common sense to judge that in such cases small coke, and a good number of pieces at that, should be interposed between the inlet and outlet. To put it in another way, the question of the most suitable size depends upon the proportionate amount of void to fuel in the fuel bed; the best proportion again varying according to the thickness of the fuel bed.

As a case in point, the writer has demonstrated upon countless occasions that broken coke is by far the most suitable fuel for horizontal steam-boilers; and he rather naturally inferred that it would also be preferable for use on vertical steam-boilers. Experience, however, showed that, owing to the fact that the construction of vertical boilers provides for a deeper fuel bed, larger coke was more advantageous, and that the use of broken coke rather tended to check the draught if fired in a thick layer, and, further, that carbonic oxide was produced owing to the thickness of the fuel bed. If, on the other hand, the fuel bed was maintained in a thin layer—say, 6 inches—the top of the fire was too far from the heating surface, and the body of heat, owing again to the thin layer, was not so great as when larger coke and a thicker fuel bed were employed. This is, of course, due to the fact that vertical boilers are not constructed to burn small coke, but only coal or large coke. With coke the greatest zone of heat —*i.e.*, a few inches above the surface—should always be kept close up to the point to be heated; with coal it is different, owing

to the fact that the flame requires a sufficient distance between the top of the fuel bed and the heating surface to enable proper combustion to be effected, and to allow the hottest portion of the flame to do the work.

So far it has been shown that the requirements of customers will vary from the small coke of ¾ inch, broken coke of 1½ inches, to large coke of over 2 inches; and it is the duty of every properly-managed gas undertaking to provide these sizes, unless, of course, the whole of the coke can be sold at a good price in its own district without the necessity of taking any special steps. Even in such cases it is highly probable that a much better average price would be obtainable were it supplied in convenient sizes or grades; for, as already mentioned, the supply of different sizes widens the market immensely; and widening a market increases the demand, with the inevitable result of a rise in price.

Domestic Requirements.

The requirements, so far as residential property is concerned, are generally not properly appreciated. The importance of supplying householders with broken, and not large coke, has already been sufficiently emphasized. The possibilities of increasing the demand for this purpose are undoubtedly immense, and when once the requirements of the householder are thoroughly realized by the supplier, and when this knowledge has been followed up by a systematic scheme of educating the domestic user how and where to burn coke, properly prepared as to size, free from breeze and water, and delivered in a convenient quantity, then the demand, in spite of gas, will be a matter of considerable surprise to everyone concerned.

Of recent years the importance of burning fuel to yield radiant, as opposed to convected, heat has been preached far and wide, especially in connection with gas-fires. With coke it has been shown that a large percentage, and more than double that of coal, of the available heat is given out in the form of radiant heat. This fact alone shows conclusively that in selling coke one has a good article to sell, and an article which, widely advertised, will take the public's fancy, in spite of the prevailing prejudice against its adoption. It is, therefore, of interest to discuss briefly the various directions in which it can be used with satisfaction by the householder.

A kitchen fire can invariably burn a large quantity of coke, though only a few can use it exclusively, depending upon the size of grate and draught in relation to the work to be done. It is the same principle as was explained in connection with the use of coke for steam raising. To give a certain amount of heat, a certain amount of coke must be burnt. With a non-volatile fuel, such as coke, this cannot be done unless the draught is sufficient. Besides, it must be borne in mind that in a grate of a certain size only half the quantity of coke by weight can be used at a time, as compared with coal. There is, therefore, roughly only half the number of British thermal units actually in the grate, which obviously renders it necessary to burn it at twice the rate to provide the same amount of heat.

At the same time it is only at certain seasons that the kitchen grate is required to work at its maximum capacity, in which case some grates, with no reserve power, would require to be fed with coal only. At all other times—and in most households for quite 75 per cent. of the day—coke could be used exclusively, or almost exclusively. It would mean that two scuttles would have to be used; and this is a disadvantage, but by no means an insurmountable one when the manager of the household realizes the great economy of burning coke instead of coal.

For sitting rooms it can be said at once that a mixture of coal and coke—broken it must be for household use—burns very satisfactorily. But how few will take the trouble to mix it. To burn coke alone, after having lighted the fire with wood and coal (unless gas is requisitioned), it should be realized that the grate must be suitable. Shallow grates are of no use for coke, and horizontal front bars are a disadvantage. Coke to burn satisfactorily must be burnt in a thick layer, like a watchman's coke bucket, though it need not be nearly so thick as that; but it should be from 6 to 9 inches in thickness at least, and maintained at a minimum of 6 inches. Unless this is done, the fire will die out through excess of air and insufficiency of the thickness of carbon in the fuel bed; and the same reasoning explains the futility of using large coke for such purposes. Horizontal front bars tend to hold-up the pieces of coke in the front and form pockets; thus disturbing the homogeneity of the fuel bed—allowing excess of air to enter at the centre of the fuel and upset its proper combustion. The front bars should therefore be vertical; thus allowing the coke to fall without check. The writer has one grate in his house which, when fed with coke, will keep alight for hours on end without attention, simply owing to its depth and the compact manner in which the coke can lie and fall as it burns away.

These points have been discussed at some length, as they require to be clearly explained in any literature intended for distribution among householders.

For coke-boilers, slow combustion, greenhouse, and garage stoves, a smaller size of coke is generally required, and, as mentioned before, this should be sold by the gas undertaking. It requires to be from about ⅜ inch to 1 inch, or a slightly larger size—say, ½ inch to 1¼ inches—will be also quite suitable. It is a moot point as to whether it is advisable to push such stoves, as in each gas would be equally suitable, even if more expensive. One might venture to remark that the best policy would be to push gas appliances where new ones have to be purchased, and push coke where suitable stoves for its use are already in existence. Many enterprising firms advertise anthracite stoves, and, therefore, there is presumably a fairly wide demand for such things. But there is no reason to prevent the manufacturers of coke from supplying fuel for these stoves. Coke is much cheaper than, and nearly as good as, anthracite; and most people would be willing to give it a trial. But it is so rarely offered to such people. That is the fault.

The Best Coke for Domestic Use.

Nothing so far has been said as to the type of coke which is most suitable for supplying the coke market; and in this connection the writer has little hesitation in saying that in nine cases out of ten the continuous vertical coke is much preferable to that from intermittent verticals, horizontals (whether heavy or light charges be in use), and inclines. For one reason it is dry quenched—an inestimable advantage which cannot be denied. It is also of an open structure, porous, and not too large. It is carbon in a most convenient form; for it is sufficiently open-grained to allow the air for combustion to enter into combination with the carbon throughout the larger portion of its entire bulk, instead of restricting the air and, therefore, the combustion to its outer surface only. Its porosity and the advantages it brings in its train are special features of continuous vertical coke. Those who have had any practical experience in the selling of coke will have realized from the beginning that the difficulty of burning coke quickly, and so of obtaining heat quickly, has been its greatest drawback, and has shut it out from many an otherwise fruitful outlet. Anything, therefore, which will enable the coke we make to burn more freely, and yet burn slowly if the admission of air be checked, should be welcomed and be appreciated at its true worth. Thus continuous vertical retort coke may be considered to be the coke *par excellence* for by far the majority of the purposes for which gas coke is used.

Horizontal Retort Coke.

Heavily-charged horizontals and intermittent verticals produce a large and dense coke, with characteristics which place it midway between the old gas coke of years ago and metallurgical coke. It is, even when broken, difficult to ignite—a fault which is partly due to the absence of volatile matter, partly to its dense nature, and partly to the presence of more or less moisture. If the draught is good, it will burn freely when once ignited, but not nearly so freely as the first coke mentioned; the difference being that the dense coke burns on its surface only, while the porous coke burns both internally and externally, and thus much more carbon is giving up its heat in a given time.

Lightly-charged horizontals and inclined retorts (usually six-hour charges) yield a smaller coke, which is not so dense, nor is it carbonized to so low a content of volatile matter; and for these reasons it burns more freely and requires less draught than the dense type of coke. For most purposes, and certainly for the domestic trade, it is much more suitable than the twelve-hour coke, though it is by no means on a par with continuous vertical retort coke; for it is not nearly so porous, and contains more or less moisture.

The twelve-hour coke has one advantage, and that is its strength for transport and for stacking in heaps. Nothing like so much breeze is made—an advantage which must not be overlooked in considering the comparative claims of the different systems, so far as coke is concerned. If, however, there is, as there should be, a good market for small coke [⅜ inch to 1 inch in size], the coke, even when broken, will still be saleable as "coke" at approximately the same figure; while the works boilers should, it goes without saying, be adapted to burn the fine coke breeze, which should range from ⅜ inch downwards.

From the point of view of the domestic user, continuous vertical-retort coke is an ideal fuel in suitable grates; and those undertakings that have adopted this system of carbonizing would be well advised to make a special feature of their domestic coke trade, reserving the vertical coke for this purpose. Properly fostered, a very considerable demand can be created and good prices obtained; for the domestic trade is, or should be, the cream of the coke trade. Makers of this class of coke should realize that they are manufacturing a high quality article, and should not be content unless they are procuring higher prices than for the remainder of the coke made in the horizontals or inclines. If such coke is reserved for the domestic user, and the other coke for the large industrial and other buyers, materially higher prices should be obtainable for the whole of the make of such coke.

DETERMINATION OF THE PERCENTAGE OF TOLUENE IN COMMERCIAL SOLVENT NAPHTHA.

By H. G. Colman, D.Sc., Ph.D.

The method consists in carefully distilling off from the solvent naphtha all constituents boiling below 138°; the distillate containing all the toluene in the sample mixed with all other lower boiling substances present in the solvent naphtha, together with xylene and small quantities of higher boiling substances. The amount of toluene in the distillate, and consequently in the volume of solvent naphtha originally taken, is found by the method already

described* for ascertaining the percentage of toluene in commercial toluol.

Mode of Carrying Out the Test.

Apparatus.—As specified in the "Commercial Toluol" test.

Corrections of Thermometer and 100 cc. Cylinders.—As described in the toluol test.

METHOD OF DISTILLATION.

150 to 200 cc. round-bottomed flask and condenser to be washed out with the solvent naphtha to be tested and allowed to drain.

100 cc. of the solvent naphtha (at 15·5°) to be tested poured into flask and distilled; using a Young twelve-bulb pear fractionating column or other efficient column—the rate of distillation being one drop per second from the end of the condenser. The distillate to be collected in a 100 cc. cylinder, and the distillation stopped when the thermometer reaches 138° C. (corrected), and the volume of distillate noted after allowing the condenser to drain.

If the amount of distillate up to 138° thus obtained is less than 35 cc., a further 100 cc. of the sample to be distilled in the same manner, and the distillates combined. If the total volume of distillate then still falls below 35 cc., the sample may be taken as practically free from toluene.

If the volume of distillate is 35 cc. or over, then 35 cc. thereof are taken, and mixed with 50 cc. of pure toluene and 15 cc. of pure benzene, and the mixture distilled as described in the article on the determination of toluene in commercial toluol; the distillates (1) below 105°, (2) from 105° to 117°, and (3) above 117° being collected and measured, and the specific gravity at 15·5° of the fraction 105° to 117° also determined. From the percentages boiling below 105° and above 117°, the percentage of toluene in the mixture is found by means of the table in the toluol article.

In cases where the original sample of solvent naphtha contains paraffins of a boiling point approximating to that of toluene, the figure thus found is too high, and a correction must be made in the following manner: For each 0·001 that the specific gravity of the fraction 105° to 117° is below 0·868, three-quarters of 1 per cent. is to be deducted of the percentage of toluene found by the table; the remainder giving the corrected percentage of toluene in the mixture. Of this amount, 50 cc. is derived from the pure toluene added to the mixture, and must be deducted—the remainder giving the number of cc. of toluene in 35 cc. of the distillate. This number multiplied by the number of cc. of distillate obtained from the original volume of solvent naphtha taken and divided by 35, gives the number of cc. of toluene in the total distillate, and also the number of cc. of toluene in the volume of solvent naphtha originally taken.

Thus, for example, 100 cc. of solvent naphtha on distillation in the prescribed manner gave 53·5 cc. of distillate up to 138°. 35 cc. of this distillate were mixed with 50 cc. of pure toluene and 15 cc. of pure benzene, and on distillation in a 100 cc. distillation flask gave the following fractions:—

Up to 105°, 24 cc.
115° to 117°, 53 cc. of sp. gr. ·855 at 15·5°.
Above 117°, 23 cc.

From the table, the percentage of toluene in this mixture is 62 per cent.; but as the specific gravity of the fraction 105° to 117° is only ·855 (*i.e.*, 13 points below ·868), $13 \times \frac{3}{4} = 9{\cdot}8$ per cent. of 62 must be deducted for paraffins. The corrected amount of toluene in the mixture is therefore

$$62 - 9{\cdot}8 \text{ per cent. of } 62 = 62 - 6{\cdot}1 = 55{\cdot}9 \text{ per cent.}$$

And deducting from this the 50 cc. of pure toluene added to the mixture, leaves 5·9 cc. of toluene derived from the 35 cc. of distillate.

The total amount of toluene in the 53·5 cc. of distillate is therefore

$$\frac{5{\cdot}9 \times 53{\cdot}5}{35} = 9{\cdot}3 \text{ cc.}$$

And the amount of toluene in the original solvent naphtha taken to the nearest whole number is 9 per cent.

Feb. 5, 1915.

* See "JOURNAL" for Jan. 26, p. 196.

EVENT AND COMMENT.

TESTING OF TOLUOL, &c.

THE restrictions imposed by the Government on the sale of benzol serve a most excellent purpose, in that an absolutely standard and uniform method of testing is brought into use. It has for a long time been a matter of much surprise that there has been no really scientific standard for testing benzol such as is produced in coke-oven plants. The terms employed are both misleading and inconsistent; the method of testing is open to a certain amount of manipulation, and is also in itself unsound. The usual procedure is as follows: 100 c.c of the crude benzol are placed in a retort, and a thermometer inserted in the neck so that the bulb of it shall be $\frac{3}{8}$ inch from the bottom. What is called a "benzol thermometer" is employed. Different thermometers emanating from different makers will give varying results. The writer has performed a number of experiments on the same sample of benzol, and has obtained results varying by as much as 3 and 4 per cent., although strict control was exercised at all points. As a consequence of this possibility of variation, much friction is caused between producers of benzol and buyers. Very frequently the buyer's test shows 2 or 3, or even more, per cent. less distillate at a given temperature than the test made by the seller. An adjustment in price is therefore necessary. On the Continent, a standard apparatus is invariably employed; and with this reasonably consistent results can be obtained. The size of the distillation flask, side tube, position of thermometer, length of condenser, &c., are all fixed, and consequently uniformity of results is secured.

Creosote oil employed for the recovery of benzol is usually purchased according to specification. A good oil should only commence to distil at 200° C., should contain only a trace of water, should distil at least 80 per cent. below 300° C., and should not contain an excessive quantity of naphthalene in the fractions of distillation after standing 24 hours—usually not more than 6 to 8 per cent. On the face of it, it seems quite clear as to what is covered by the specification. In reality, it is a mere generalization, the interpretation of which is dependent on the personal factor, and which is, moreover, largely affected by the method of testing adopted. There is no standard method or apparatus, but only a kind of hazy notion, interpreted by individual chemists to meet their own needs. The quantity of naphthalene in the oil is rarely, if ever, estimated properly. The usual method is to distil the oil, and collect fractions at 200° C., 230° C., 280° C., 300° C., allow these to stand 24 hours, let the naphthalene settle out, and estimate the quantity. The writer has invariably found that such "estimates" are pure guesses, and may be even 100 per cent. out. The need for standardization of such tests will, therefore, be perfectly obvious to the reader. A Benzol Producers' Association, such as has already been advocated, could certainly do much in this matter.

The communication from Dr. H. G. Colman on the "Determination of the Percentage of Toluene in Commercial Toluol," which appeared in the "JOURNAL" for Jan. 26, would be read with great interest by coke-oven people. At the present time, benzol itself is not selling particularly well, nor are certain products of tar distillation. The principal products in demand are toluene and carbolic acid; and for these exceptionally good prices are being realized. Hence many coke-oven people are desirous of knowing how far they are able to go on with any schemes for making toluene, and the tests set forth by Dr. Colman will enable them to satisfy themselves on the point—at any rate, within a reasonable degree. Dr. Colman has no doubt proved to his own satisfaction that the results obtained by his method are reasonably accurate when the test is performed with commercial, instead of crude, products. Dr. Colman says that the presence of the usual impurities in the commercial toluol does not materially affect the results as compared with those obtained using mixtures of pure products. The writer has recently been engaged on a series of experiments of a similar nature to those of Dr. Colman—but with a different object—and he has found that the impurities have very little effect indeed, more particularly if the fraction boiling below 80° C. is omitted. [The writer's experiments were with benzol, whereas Dr. Colman's were with toluol.]

COKE-OVEN GAS FOR POWER.

In these notes a fortnight ago the writer referred to the increasing use of coke-oven gas for power purposes, particularly in connection with the generation of electricity at collieries. At a meeting of the Junior Institution of Engineers (Sheffield Section) held in Sheffield on Friday, Jan. 29, a lecture was given by Mr. G. S. Cooper on "Modern Bye-Product Coking," in which reference was made to the various uses to which coke-oven gas was now being put—such as town lighting, boiler firing, gas-engines, &c. In the discussion which followed, a very important point with regard to the full utilization of surplus coke-oven gas was raised by Mr. J. H. W. Laverick, the Managing-Director of the Tinsley Park Collieries, Sheffield. This Company has recently erected a new battery of regenerative coke-ovens, the surplus gas from which is to be sent some hundreds of yards to fire the colliery boilers. Mr. Laverick said that it was well known that the most economical way of utilizing the gas was to consume it in gas engines. On a colliery, the only real use for a gas-engine was to generate electricity. Now collieries with steam winding engines needed a lot of steam, and also produced a large amount of exhaust steam. At Tinsley this was used in mixed pressure turbines which gave them all the electricity they required. Consequently, to utilize the gas for steam-raising was for them the most satisfactory course. This is a point which is frequently overlooked when charging colliery owners with not making the most of their resources. Electric winding engines are now being adopted; and in such cases it would, of course, be more advantageous to consume the surplus gas in gas-engines.

Institution of Heating Engineers.—The annual general meeting of this Institution is being held to-day at the Holborn Restaurant. In addition to the Presidential Address of Mr. H. H. Grundy, a number of reports are to be presented, and two papers submitted—one by Mr. W. R. Twigg, on "Science in the Development of Gas Heating;" and the other by Mr. E. Herring, on "Some Recent Theories of Ventilation Considered in their Relation to Present-Day Practice."

A NEW RADIOMETER FOR GAS-FIRE TESTING.

PART I.

[A Communication from the Research Department of the Richmond Gas Stove and Meter Company, Limited.]

THE radiometer at present used in connection with the Leeds test, as recommended by the Gas-Heating Research Committee,* is a device by Professor R. H. Smith. In this instrument a steady stream of water passes through blackened copper tubes having a definite superficial area exposed to the radiating source. The heat absorbed is equal to the product of the increase in the temperature of the water itself, in flowing through the tubes, multiplied by the weight of water flowing during a definite period of observation. This method and apparatus have been employed by the coal-gas industry for the last five years as the standard for computing the radiating efficiencies of the various appliances manufactured; but at the same time there has been a growing force of opinion that the results obtained were not so reliable as was necessary. It has been accepted generally that the method, in its broad outline, is very satisfactory, as, in addition to supplying information concerning the absolute radiant efficiency of a fire, it enables the worker to determine the manner of distribution of the heat from the fire.

In a lecture given by one of us some time since,† the type of error which might be introduced during the determination of the distribution of the heat from the fire was discussed. Although any actual error in the determination of the distribution factor is doubled in the efficiency result of the present-day gas-fire, nevertheless the degree of accuracy obtainable by the use of a Rubens thermopile is probably sufficiently satisfactory, at any rate for comparative purposes. A standard method of procedure must be adhered to, and reasonable precautions taken during the determination.

We are of the opinion, however, that it is essential that a radiometer capable of giving more accurate results under the conditions of the test should be employed in these determinations. We propose to describe an instrument which we have had in use now for several months, and which during this period has given entire satisfaction, and has shown itself to be a very distinct improvement upon the radiometer at present regarded as the standard instrument for the test.

ORIGINAL APPARATUS FOR THE LEEDS TEST.

Prior to the description of the construction and examination of the new radiometer, it seems to us desirable to point out what appear to be the objections to the use of the R. H. Smith instrument. Both from the practical and the theoretical standpoint, objections can be cited to the use of a hemispherical radiometer for enclosing totally the front of a gas-fire in the determination of the heat radiated. The Gas-Heating Research Committee decided to make a determination of the energy radiated on to a given area in front of a fire, and then, by means of the Rubens thermopile, to explore the heat distribution over the hemisphere at the centre of which the fire was situated and on the circumference of which the radiometer determination had been made. The actual details of the method were worked out to enable the R. H. Smith radiometer, the absorbing surface of which measures 12 inches by 12 inches, to be employed.‡ In this instrument the heat absorbent tubes are packed quite close together, and are coated with lampblack. A blackened shield of sheet iron projects outward for a distance of 6 inches, to protect the face of the tubes from adventitious air currents, and is insulated from the absorbing surface by strips of a non-conducting material—apparently blackened wood. The instrument is supported on a large blackened board, clamped to a stout iron pillar, along which it can be moved. Suitable reservoirs are supplied for determining the temperature and steadying the flow of the water through the instrument. These reservoirs are attached to the back of the board, and are surrounded by some non-conducting material—such as slag-wool. The temperature of the water is read to 0·01° C.

The makers of the instrument advise that the water-flow shall be proportioned to the rise of temperature (so that the percentage of error in each of two measurements is about the same) and also that the rise in temperature of the receptive surfaces shall be so slight that their loss of heat by radiation is inappreciably small. They state that it is advisable to place the instrument at no less a distance than 6 feet from the source of radiation, so as to secure an approximately parallel radiation falling upon it.

In the Gas-Heating Research Committee's report, it is stated that the radiometer is to be placed at a distance of 34·4 inches from the fire. A semi-circle of this radius measures 108 inches in circumference; and a hemisphere with the same radius would have a surface area of about 144 square inches between the parallels 10° N. and 10° S. and the meridians 10° E. and 10° W. This procedure means that the instrument will be subjected to more than four times the density of radiant energy that it would receive if used under the conditions recommended by the makers! While offering criticism of the use of the instrument in this particular test, we are not in a position to criticize the radiometer when tested under the conditions recommended by the makers. Time has not allowed us to continue tests at a distance of 6 feet from the fire, as these would not serve for us any useful purpose. In view of the large amount of heat which has to be absorbed from the larger modern fires under the ordinary test conditions, we have not been able always, in the tests to be cited, to keep the rise in temperature of the water passing through the instrument as low as recommended. We do not think, if there had been ability to do this, that the radiometer would have given satisfactory results. The makers consider a temperature rise of from 6° to 10° Fahr. as suitable. As will be shown later, even under such conditions, difficulties would occur in connection with the determination of the real cooling correction.

THE TIME-FACTOR.

From the point of view of a works' laboratory staff there are several objections to the "R. H. S." type of radiometer. Outstanding is the important objection on the score of time. A test-room has to be heated to a suitable temperature, and this temperature has to be maintained constant over the long period of time necessary to attain temperature equilibrium of the water stream in the instrument. Our experience is that not more than two complete tests can be carried out by the experimenter in an ordinary nine-hour day, and that often it may not be possible to complete more than one test per diem.

LIMITATIONS OF THE ORIGINAL APPARATUS.

Leaving for a moment the question of the time-factor, it will be of interest to examine critically this radiometer with regard to the experimental errors which occur during its use in connection with the Leeds test.

In November last it was pointed out by one of us that the framework of the apparatus at least ought to be protected from the heat radiating body, and some of the shortcomings of the instrument were indicated by the statement that the protective shield should stand in front of the radiometer tubes themselves. In the experiments to be described, a large sheet of brightly polished copper was employed, where indicated, to protect the framework of the instrument from the radiating sources. To protect the tubes from direct radiation, when necessary, a second screen, composed of three sheets of copper polished, and held together in a light wooden frame at a distance of 3 inches from one another, was employed. This was found to ensure ample protection. An endeavour has been made to compute a basis for the determination of the real cooling correction under all experimental conditions, but with little success. It is most satisfactory (as will be shown later) to regulate the experimental conditions so as either to eliminate entirely the cooling correction or to make it small, and thus minimize the error unavoidably introduced during the computation.

THERMAL INSULATION OF THE R. H. SMITH RADIOMETER.

For the analysis of the accuracy of this water radiometer for the use under consideration, a series of tests with added thermal protection of the instrument, of which the following are a representative set, were first carried out. A 16-inch "Flambeau" fire was employed, and the radiometer was placed in the usual position for the determination of the heat radiated on to the area of one foot square in front of the fire. Observations were made also with the new Richmond radiometer placed in the o/40E. position in front of the fire. The latter determinations, which were made at the beginning and end of the main experiments, served as a check on any variation in the rate of heat radiation by the fire during the tests. Fig. 1 serves to show the relative positions of the copper shield used to protect the framework of the R. H. Smith instrument during the various tests. The results corrected for slight variations in gas consumption are summarized in Table I. It will be observed that the protective shield served

TABLE I.

Description.	Heat Absorbed by R.H.S. Radiometer in o/o Position.	Water Flow. Gms. in Five Minutes.	Temperature Rise of Water °C.	Laboratory Temperature °C.	Mean Water Temperature °C.	Net Temperature Rise in Richmond Instrument in o/40 Position °C.
Tubes shielded from fire, copper shield in position A . .	12 20	800	1·27	22·1	14·94	..
Tubes exposed to fire copper shield at A	125·9	815	12·87	22·2	21·67	5·43
Do., copper shield at C	127·9	802	13·29	22·0	21·14	..
Do., copper shield removed entirely .	129·7	794	13·62	22·2	21·13	5·44

The Richmond radiometer in o/o position at end gave a centre reading of 123·6 K.C.U. per hour.

* "Proceedings of the Institution of Gas Engineers," June, 1909. See "JOURNAL," Vol. CVI., p. 821.

† H. Hartley, Inaugural Lecture to the Yorkshire Junior Gas Association, 1913. See "JOURNAL" for Nov. 11, 1913.

‡ All centre readings given later refer to an area of 144 square inches.

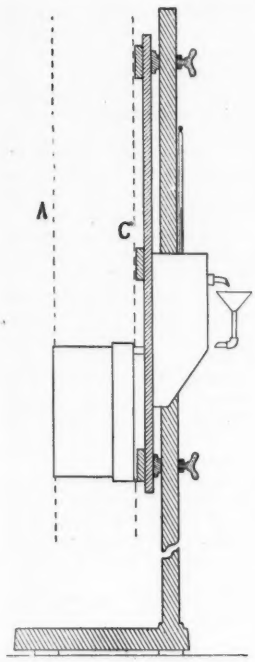


Fig. 1.

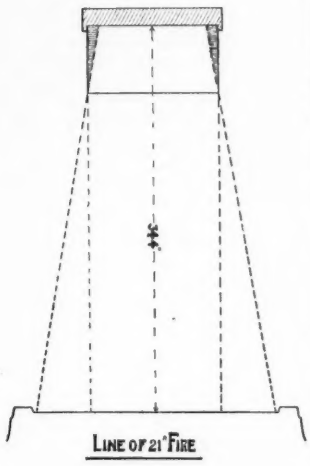


Fig. 2.

to decrease the heat absorbed by the water in its passage through the instrument by 4 K.C.U. per hour. During the series, the water-flow was kept practically constant, and each set of observations was repeated.

Effect of the Mean Temperature of the Water on the Results.

In some further tests with the same fire, determinations of the total heat absorbed by the water in its passage through the instrument were made with different rates of water flow. The framework of the radiometer was protected by the large copper shield in position "A" (fig. 1) in the results marked "A" and unprotected in "B." The results are embodied in Table II. The two series of tests were carried out on different days; the conditions regarding gas consumption and calorific value not being quite the same.

Table II.

Time.	Centre Reading K.C.U. per Hour.	Water Flow in Five Minutes. Gms.	Rise. ° C.	Mean Water Temperature. ° C.	Laboratory Temperature. ° C.	Richmond Radiometer. K.C.U. per Hour.	Richmond Radiometer. Position.
p.m.							
2.15 A.1. .	117·2	688	14·20	20·63	20·50	89·08	0/40
5.30 A.2. .	108·8	446	20·35	24·94	22·20	90·38	0/40
5.45 A.3. .	—	—	—	—	—	119·8	0/0

Assuming the difference between the A.1 and A.2 values with the Richmond instrument are due to calorific value changes, and correcting for this we get—

A.1. Centre reading $= 117{\cdot}2 \times \frac{90{\cdot}38}{89{\cdot}08} = 118{\cdot}9$, as against 119·8 with Richmond instrument.

Noon.							
12.0 B.1. .	129·7	794	13·62	21·43	22·2	—	—
p.m.							
3.0 B.2 .	119·6	532	18·76	24·93	22·0	—	—
6.0 B.3 .	With tubes shielded from fire						
	10·0	500	1·67	17·6	22·0	—	—

Thus, with a given water flow and a given laboratory temperature, it would appear from the above that relatively low results would be obtained, in comparing two fires, from the fire having the higher centre reading if the water-flow were not altered to maintain the same temperature rise. This is an indication of the importance either of maintaining a constant mean temperature for the water in the instrument, together with a constant laboratory temperature during comparative tests, or of determining a true basis for the calculation of the cooling correction. These results prove that a relatively small temperature change may produce a very important variation in the total heat absorbed. In the first of the preceding experiments the flow of water through the instrument was adjusted so that the mean of the inlet and outlet temperatures was nearly equal to that of the laboratory. Under such conditions a very small cooling correction ought to be necessary, and the actual result is in close agreement with that obtained with the Richmond radiometer. This concordance can only be regarded as to some extent accidental, and is probably due to the neutralization of two errors of opposite sign introduced by the projecting wind screen: (*a*) The error due to the transmission to the tubes of heat absorbed on the inside of the screen; (*b*) the error of opposite sign due to the partial shielding of the tubes from the extreme radiants of the 16-inch fire.

Cooling Correction in the Leeds Test.

In a letter to the Technical Press in November, 1913, attention was drawn to the fact that the ordinary method of determining the cooling correction in use in connection with the Leeds test was not sound theoretically. The procedure consists in the estimation of the heat absorbed by the water in its passage through the instrument when the latter is shielded from the fire. The value for the K.C.U. per hour absorbed under these conditions is subtracted from the total K.C.U. per hour absorbed when the tubes are exposed to the fire.* In the first case the water is heated up both by radiation from the surrounding warm objects in the test-room and by contact of the warmer atmosphere with the face of the copper tubes. In criticism of this procedure, the figures in Table III. were given.† The temperatures recorded were obtained during the test of a fire: (1) With the radiometer tubes shielded; (2) with the tubes exposed to the radiations from the fire.

Table III.

—	1.	2.
Temperature of water entering instrument . .	13·05	13·05
Do. leaving do. . .	14·35	23·81
Temperature of test room	22·40	22·40
Mean temperature of the water in the radiometer	13·70	18·43
Difference between mean temperature of water used in instrument and that of test room . .	8·70	3·97

Thus it will be seen that the difference in the temperature between the water in the radiometer tubes and the air of the room is materially different in the two cases; so that it is fallacious to subtract the total heat absorbed per hour in case (1) from the total heat absorbed per hour in case (2) in the estimation of the heat radiated by the fire on to the area of 1 square foot.

The temperature rise of the water under (2) above is somewhat higher than is specified in connection with the radiometer. But even had this not been more than 6° C., and had the figure in the bottom row of the second column become 6 instead of 3·97, it is obvious that this variation in temperature would be equivalent to an appreciable change in the heat absorption.‡ This may be inferred from Table II., in which it is shown that when the mean temperature of the water in the instrument was allowed to rise 3° C. above the laboratory temperature there was a drop of 8 K.C.U. in the total heat absorbed per hour, and from the experiments given in Table I., during which the heat absorbed when the tubes were screened from the fire was equal to 12 K.C.U. per hour.

In view of the importance of the rate of heating-up or cooling-down of the water in its passage through the instrument, due to difference in temperature from the surroundings, a discussion of this point by the Gas-Heating Research Committee in their original work would have been useful.

It would appear to have been tacitly assumed that the procedure indicated by Yates is the correct one. If it were not for the existence of the wind screen in this radiometer it might be possible to compute the true cooling correction, with a moderate degree of accuracy, on the basis of Newton's law. That is to say, referring to Table III., true correction = cooling correction observed in (1) $\times \frac{3{\cdot}97}{8{\cdot}7}$. But the projecting wind screen of blackened sheet iron, which has a superficial area of 2 × 288 square inches, becomes hot when the instrument is exposed to the fire, and tends to heat-up the air of the laboratory before it reaches the water tubes. That the heat absorbed by the screen is such as to materially interfere with the heat absorbed by the radiometer has been shown by the results given in Table I. The influence of this portion of the instrument on the heat absorbed by the tubes is further shown by the following.

About 15 months ago there was constructed in the Richmond laboratories a water-tube radiometer in which the large framework of the R. H. Smith instrument was abandoned and the smaller wind screen adopted was water jacketed, so as to enable desired temperature conditions to be obtained inside the screen. A number of tests were carried out with this instrument. The final details as to the most suitable conditions for the use of the apparatus were not worked out, as a much more promising line of work had begun. In the present connection we are concerned with the effect of lowering the temperature of the wind screen, by passing a stream of water through it, on the total K.C.U. absorbed per hour by the tubes when exposed to the fire. Some experimental results bearing on this point are given in Table IV.

* *Vide* H. J. Yates, "Journal of Gas Lighting," Nov. 18, 1913, p. 584.

† H. Hartley, "Journal of Gas Lighting," Nov. 25, 1913, p. 687.

‡ Speaking of the heat absorbed under (1) above, which he incorrectly calls the convection correction, Yates (*loc. cit*) said "the correction generally amounts to approximately five units in the radiant efficiency result." See "Journal," Nov. 18, 1913, p. 584.

TABLE IV.—*Radiometer with Water-Jacketed Screen.*

Wind Screen.		Laboratory Temperature.	Radiometer Water Temperature.				K.C.U. per Hour Absorbed.	
Water Temperature.			Tubes Shielded from Fire.		Tubes Exposed to Fire.			
In.	Out.		In.	Out.	In.	Out.	Tubes Shielded.	Tubes Exposed.
Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.	Deg. C.		
12·95	13·06	22·3	13 28	13·43	13·95	16·90	3 2	63·5
No water in screen		22·5	13·43	13·67	13·90	17·12	5·1	69·5

It will be noticed that the presence of the water in the wind shield had a marked effect on the total K.C.U. absorbed by the instrument.

We incline to the view that it is best with the R. H. Smith radiometer to work with the mean temperature of the water in the instrument at the laboratory temperature, and have the framework shielded as indicated in fig. 1. If the mean temperature varies from that of the laboratory by a small amount—not more than 1° C.—the correction to be applied can be calculated, on the basis of Newton's law, from the cooling correction determined when the tubes were shielded from the fire. In this way, the error is probably minimized.

FURTHER INTERFERENCE OF THE WIND SCREEN.

The last objection to the R. H. Smith instrument which we propose to mention also arises out of the presence of the wind screen. Many of the fires in use have larger fronts than 12 inches, and in some cases even the radiants extend over 21 inches. The blackened screen projecting 6 inches from the front of the water tubes shields part of the latter from portions of the fire, and tends to lessen the heat absorption. This is indicated in fig. 2. The shaded portion of the radiometer represents the screening from the respective side portions of the fire.

SUMMING-UP THE OBJECTIONS.

In view of the various possible sources of error which have been indicated, it does not appear to us that the R. H. Smith radiometer can be adapted to the Leeds test to give absolute results, although, as is to be expected, it is feasible, by rigorously maintaining constant conditions and taking the precautionary measures we have indicated, to obtain results from a given fire which do not differ by more than 1 per cent. The results for the radiation efficiency of gas-fires obtained in such a manner may contain a constant error which will probably vary with the size of the fire.

A radiometer employing running water as the heat absorbent would, even if accurate, be unsatisfactory from a works point of view, owing to the time required for testing a fire satisfactorily—any hurrying of the experimental working being, in our opinion, undesirable and liable to give results in agreement with preconceived ideas.

[The second part of this article, giving a full description and illustrations of the new radiometer, will be published when the provisional protection of the instrument by the Patent Office has been completed.—ED. J.G.L.]

AT THE WADDON (CROYDON) GAS-WORKS.

Visit of the London and Southern Junior Association.

Among the party of members of the London and Southern District Junior Gas Association who proceeded last Saturday afternoon to Waddon, for the purpose of inspecting the works of the Croydon Gas Company which are situated there, were a number who recalled a similar visit which took place very nearly six years ago. To these probably—at any rate, this was so with the writer—when looking at the different parts of the works, it seemed that but a little time had elapsed since they last stood there, listening to the explanations of Mr. James W. Helps with regard to the comprehensive extension scheme which he had at that time newly carried out, and the further constructional work then in hand. But however clearly time may be bridged by memory, the fact must remain that six years is a long while. Even in quieter and happier days than those we are living in just at present, much must be expected to happen within such a period; and the Croydon gas undertaking has proved no exception to the rule in this respect. The visitors on this occasion were not received by Mr. Helps, who has in the meantime retired; and the continuously increasing demands for gas have called for still further extensions of the works.

Waddon Station on the London, Brighton, and South Coast Railway is but a short distance from the works, which now cover about 34 acres of ground, through which the Railway Company's Wimbledon line runs, affording excellent facilities for the importing and exporting requirements of the works. For this purpose, there are two sets of sidings, one running through the retort-houses at a height of about 14 feet from the ground, and the other being on the ground level. They are connected to the main line at both ends of the works, at the gates of which the party were warmly welcomed by Mr. A. Caddick (the Engineer and Manager), who had with him Mr. G. W. G. Tatam (his Chief Assistant), Mr. F. J. Harrisson (Chief Draughtsman), and Mr. S. Ringham. Under the leadership of these gentlemen, the tour of the works generally was made; while Mr. W. J. Sandeman (the Distributing Engineer) acted as guide through the stove and fitting departments. At the outset, Mr. Caddick announced that the "round" would take about two hours—and it did; but so much that is worthy of note is there to be seen at Waddon, that even this time was sufficient to allow of no more than the shortest practicable pauses over each different item of interest. The visit possessed many features, and one of the principal ones was the inspection of a newly-completed gasholder tank, having a diameter of 226 feet. The internal framing is in position; and it is hoped that this additional storage capacity will be available by the end of next October. The holder will add very materially to the Company's resources, as it will store about 6½ million cubic feet. It is being erected by Messrs. Ashmore, Benson, Pease, and Co., and will consist of four 45-feet lifts. Later on an opportunity was afforded of looking at the excellent drawings for the holder, which were prepared by Mr. Harrisson, and on which competitive tenders for the carrying out of the work were invited. There is no need to go into the details of the works now; for this has been done already, with numerous photographs, in previous issues. Those desirous of informing themselves, or of refreshing their memories, as to the lines on which things have been arranged at Waddon, may be referred to the numbers of the "JOURNAL" for Nov. 26, 1907, April 20, 1909, and June 21, 1910.

The next direction in which an extension of the works is likely to be seen is in the carbonizing department. The retort-houses now in use are designated Nos. 2 and 3. There is a No. 1 house; but pending its need for other purposes, it has been assigned the duty of acting as a coal-store. Now, however, it is required for "other purposes," and is to be re-constructed and filled with retorts. The nature of these retorts will in due course be revealed; but for the moment it may suffice to note Mr. Caddick's remark that the house "looks easily adaptable to verticals." As to the existing carbonizing plant, No. 2 retort-house, which is 200 feet long by 72 feet wide, contains fifteen settings of ten retorts on the regenerative system (arranged in five tiers), erected by West's Gas Improvement Company. The stoking machinery, with coke-discharger—both driven by compressed air—is by the same firm; and there is also installed a West hot-coke conveyor. Eight-hour charges are worked; and the house is capable of producing 2½ million cubic feet of gas a day. No. 3 house is of nearly twice this capacity—namely, 4¼ million cubic feet a day. It is 390 feet long by 50 feet wide, and contains 29 settings of eight retorts—fourteen beds of West's and fifteen beds of Drakes'. The retorts are all on the regenerative system; and here also eight-hour charges are worked. The stoking machinery and coke-discharger are similar to those in the other house; but the coke is dealt with by Jenkins-De Brouwer conveyors. The coal breaking plant and the conveyors for dealing with both coal and coke in No. 2 house are driven by electric motors; the electricity being generated by two 60 k.w. dynamos, operated by two 110 B.H.P. gas-engines. Gas-engines and steam power are used for similar purposes in connection with No. 3 house. The coke arrangements are of a very complete character in connection with each retort-house, suitable conveying, storage, and screening plant being provided. Outside No. 2 house there is an electric crane, which picks up skips filled with the coke, and raises them to the hoppers above.

The works are, of course, divided into two complete sections. That is to say, when Mr. Helps came to the conclusion that an extension scheme was called for, he decided, instead of enlarging the old section, to build an entirely new section. This it was that the members found at work in 1909; and they were also able to see work in hand in connection with the remodelling of the old section, which was subsequently completed. In both sections the condensing and washing plant is under cover, thus securing the advantages of more equable temperature, more comfortable working conditions for the employees, and, no doubt, better preservation of the plant. The apparatus (in one house) through which the gas from No. 1 section passes consists of water-cooled condensers, Livesey washers, and ten-chamber Kirkham, Hulett, and Chandler centrifugal washers. The gas in connection with No. 2 section, as it leaves the retort-house, is passed through Colman "Cyclone" tar separators, to take out the heavy tar; and it then goes through a hot washer containing carburetted water-gas tar. After this the gas passes into the condensing and washing house for this section, where it is in due course treated in water-cooled condensers, Livesey washers, and Kirkham, Hulett, and Chandler "Standard" washers. At present hot coal-tar sprays are being used at the top of the condensers, which keep the tubes quite clean; while the interior of the outlets is sprayed with carburetted water-gas tar. Here the principle of "snap" condensation is practised. The gas is led in at as high a temperature as possible—say, 120° to 130° Fahr.—and then brought down as low as it can be got—perhaps, to 60°. Naphthalene, it may be remarked, is not a source of trouble to the Company. The Livesey washers contain cold carburetted water-gas tar; and the rotary washers are packed with iron bundles, which are found to give little or no trouble. Everything drains to seal-pots outside the house; and in connection with the systems of mains, valves, and more or less complicated pieces of apparatus, an excellent method adopted is to display on the walls of the respective

buildings coloured plans of good size, so that new men may be able to thoroughly understand what it is they have to deal with. In case of emergency, these would prove invaluable.

The "Hastings" carburation process is used at the inlet to the works governors, for the purpose of removing the last traces of naphthalene. In this, ordinary "Tea Rose" oil is employed, in the proportions of about 3½ gallons per million feet of gas; the oil being forced into the apparatus at high pressure, in a number of very fine streams. For purifying in No. 1 section there are nine purifiers; and for No. 2 section, six boxes, with Clapham's "Eclipse" rubber joints, and Milbourne valves. All oxide of iron is used. Oxide from the carburetted water-gas plant, when it gets too tarry, is placed in heaps, and then the waste gases from the sulphate plant are passed through to dry it. This arrangement is found to work efficiently. The sulphate plant is of the Wilton type, with centrifugal dryer; but it was not seen working on Saturday afternoon, in consequence of difficulty in procuring adequate supplies of acid. The carburetted water-gas plant, it should be mentioned, is on the Humphreys and Glasgow system, and comprises two sets each capable of producing 1,000,000 cubic feet a day, and two sets each of a capacity of 750,000 feet.

The coal gas for the No. 2 section passes through a Thorp and Marsh "Rotary" meter of 180,000 cubic feet per hour capacity, which Mr. Caddick finds very accurate indeed in working, under proper conditions from the point of view of attention. The gas on the inlet of the works governors is raised to a pressure of 10 inches, by means of two Sturtevant turbo-driven blowers, each of a capacity of 600,000 cubic feet per hour. The supply to the Caterham district (some 6 miles away) does not pass through the governors, but is sent from the works (at the pressure named) to the holders there.

The last part of the works visited was the admirably arranged portion devoted to the stove and fittings stores and repair shops. These are conveniently arranged round a space into which vans and motors are brought for the delivery and despatch of goods. All the new cookers now stocked by the Company are made to their own designs. There are three patterns—the "Purley," the "Croydon," and the "Waddon"—the last-named being hired out at 1d. a week, or 1s. a quarter. The burners of the cookers are fitted with gas-adjusters and no air-adjusters; and as a screw-driver is needed to turn them, there is little fear of interference. They are, too, all made with a sliding tray at the top, so that it is possible to get at the flue-space without taking the top of the oven off. This is found not to interfere with the oven efficiency. The shelf is made to move stiffly, so that the consumer is unlikely to pull it out. The stock of cookers seen was small; but this is not to be wondered at, as there are over 25,000 on the district. A good range of fires is stocked, all of modern makes; no old patterns being sent out. In another part of the well-furnished stores were found the street-lamp fittings used on the district. These consist of a Sugg set, with pressure governor, and inverted No. 4 burner, with no inner glasses. As is well known, instead of the more usual prepayment system, the stop-meter principle is adopted at Croydon; gas being charged at the ordinary price.

All cookers that are brought in are baked in a muffle furnace. The time they remain in varies according to the temperature, but is generally round about four hours. The enamelled parts go into the furnace as well as the other portions. There are also two sand-blast machines, in which stoves are treated. The brass-work is boiled; and two retorts are kept going for Bower-Barffing the oven fittings and burners. This process is found to be a great advantage, as there is no smell on first lighting-up afterwards. The Company do all their own lacquering, bronzing, &c.; and, indeed, like the manufacturing side of the undertaking, this department appears to be right up-to-date in every respect.

The inspection concluded, the party were invited by Mr. Caddick to adjourn to the offices for tea, after which,

The PRESIDENT (Mr. J Hewett) referred to the enjoyable afternoon they had all spent, and to the many features which the works possessed. They had, he said, been most fortunate in being able to see a large gasholder in course of construction. This, he believed, was being erected to the designs of the staff on the works—a fact which demonstrated the advantage of having expert technical men about a gas-works. The "Rotary" meter was another point of interest. Any doubts as to the accuracy of this were set at rest by Mr. Caddick, who had told them that, provided it was kept in proper condition, he could rely upon it registering his gas correctly to within ½ per cent. If it was as accurate as this, and took up so small an amount of space as they had seen, it was a great improvement on the wet meter for measuring the make of gas on a works of these dimensions. The men were very fortunate in having such a large proportion of the plant under cover; and the appearance of everything showed how well things were looked after. In fact, Waddon was altogether as fine a works as anyone could wish to go over. They were all very grateful to Mr. Caddick and his assistants, for showing them round and placing everything before them for inspection; and he proposed a very hearty vote of thanks to these gentlemen.

Mr. S. B. CHANDLER seconded, and said they had had a really happy and educational visit, and one which would remain for a long time in their memories. In the case of the Croydon Gas Company, the relations existing between the manufacturing and distribution departments appeared to be of the happiest possible description; and this augured well both for the undertaking and for the consumers. He was sure they would wish to couple with the resolution of thanks the name of the Distributing Engineer, Mr. Sandeman, who had given them much information as to the selling side of the business.

Mr. CADDICK, after the vote had been heartily passed, said he would first of all like to tell the members how pleased they were to see them there that day. If they had enjoyed their visit, those on the works would be amply repaid for any little trouble they might have taken in connection with it. This he could safely say on behalf of them all. No doubt, it would have been noticed that the works were still to a certain extent in a state of transition. When the members were last there, in April, 1909, there was a new section at work; and now they had the reconstructed apparatus on similar lines in the No. 1 section. They were glad to see the end of the old washers and scrubbers. These no doubt did well years ago; but the works had outgrown the apparatus, and they were all pleased the new plant was in operation. He hoped that so long a time would not elapse before the Association came again to Waddon, and that on the occasion of their next visit they might be able to see No. 1 retort-house with some retorts in it. What the retorts would be, he must not say; but the house looked easily adaptable to verticals. [Laughter.] They had been so hard pressed in the matter of storage that at times he really almost felt that he had a grievance against his friend Mr. Sandeman over the forward policy he pursued in connection with the distribution department—he sent out so many fires. However, when they got the new holder into working order, they would be trying to entice him to continue this policy as enthusiastically as possible. [Laughter.] They were all much indebted to Mr. Sandeman for being with them that afternoon. As to the new holder, they would see on the walls of the room the drawings for this, which were prepared in the offices there and sent out for competitive tender. Messrs. Ashmore, Benson, Pease, and Co. were the successful firm; and they had done very well. The date fixed for completion (Oct. 31) had attached to it both penalty and premium provisions. In this matter, he wished to give credit where credit was due. Mr. Harrisson, their Chief Draughtsman, made these drawings entirely himself; and he was sure they would all agree that they did him very great credit. The cost of the holder would not be excessive. The contract for the tank amounted to about £22,000, and that for the holder to just under £40,000; the figure working out, on the capacity of 6½ million cubic feet, to about £9 5s. per 1000 cubic feet. The amount of steel work would be approximately 2400 tons. He thought, if a company could afford to do it, that it paid in the end to put the washing and scrubbing apparatus under cover. He would look forward to the next visit of the Association.

Mr. SANDEMAN remarked that it had been a pleasure to show the members what he could of his department. It promised well for the future of the industry when they found so many men giving up their spare time to an endeavour to learn something more about their business. Perhaps they had seen something to interest them in the stove shops. He thought they had pretty well everything they could have there in the shape of the latest appliances.

Mr. TATAM said it had been a great pleasure to him to meet the members of the Association, and to do what little he could to assist in showing them the works, in which those connected with the Company took pride.

Mr. HARRISSON also said he had spent a very enjoyable time with the members.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The second half of the session of the Scottish Junior Gas Association (Western District) was inaugurated on Saturday.

The VICE-PRESIDENT (Mr. David Fulton, of Helensburgh), who presided, stated that the next meeting would be on the 20th inst., when a visit had been arranged to the works of Messrs. Alder and Mackay, Edinburgh.

Mr. ROBERT BARR, JUN. (Kilmarnock), read a paper on "Some Notes on Tar Dehydration and Benzol Recovery." This, with a report of the short discussion to which it gave rise, will be found on p. 320.

Mr. A. DALE (Beith) was to give an address on "A Country Gas-Works, Past and Present," but as he was unable to attend the meeting, owing to a slight accident, the paper was read by Mr. Fulton.

SCOTTISH JUNIORS AT DUNDEE.

Inspection of the Woodall-Duckham Vertical Retort Plant.

A number of the members of the Eastern District of the Scottish Junior Gas Association visited Dundee last Saturday afternoon, to inspect the Woodall-Duckham vertical retorts which have been recently erected there. In spite of the very inclement weather, there was a fairly large attendance.

The visitors were met at the works by Mr. Alex. Yuill, the Engineer and Manager, Mr. Keillor, Mr. Johnstone, and Mr. Donald, who convoyed them through the new retort-house and explained the working of the system.

DESCRIPTION OF THE RETORT-HOUSE AND PLANT.

The retort-house consists of a steel-framed structure formed of rolled steel joists and channel stanchions; the walls being filled in with 4½-inch brick panelling with "Bricktor" reinforcement. The installation consists of two parallel benches of five settings each, containing four retorts each, producer, regenerator, waste gas flue and damper, each setting being thus entirely independent. One producer and regenerator are constructed to each setting of four retorts. A straight joint is formed between each setting, in order that any one setting may be let-down or heated-up without in any way interfering with neighbouring settings.

The installation consists of 40 vertical retorts, each capable of

carbonizing 5½ tons of first-class Scotch coal per twenty-four hours, giving a total throughout of 220 tons of coal, and yielding 2,695,000 cubic feet of 16-candle power gas of 500 to 510 B.Th.U. net. The fuel required for the producers averages 12 to 12½ per cent., provided the ash content does not exceed 6 per cent.

The coal is brought into the store in railway waggons on an elevated track. The waggons are up-ended by means of a hydraulic tipping ram, and the coal discharged into a hopper placed directly under the rails. The large coal is fed by means of a jigging-screen into a 30-ton per hour tipping tray conveyor, and then passes into a rotary filler which feeds into a 50-ton per hour gravity bucket conveyor. The conveyors are electrically driven. The capacity of the overhead hoppers is equal to 48 hours' maximum consumption.

At the top of the retort is a cast-iron mouthpiece, to which is attached the coal-feeding device, the gas off-take, and the regulation division plate. From the overhead hoppers the coal is fed through special valves into auxiliary supply hoppers attached to the mouthpiece of each retort. From the auxiliary hoppers the coal falls by gravity into the retorts at a speed governed by the rate of extraction of the coke at the bottom. The speed of the descent is regulated so that coal entering at the top is gradually carbonized in its passage through the retort, and is converted into coke by the time it arrives at the bottom. From seven to eight hours after the coal enters the retort, it is discharged as coke. There is no naphthalene in the gas, owing to the regulated instead of haphazard cracking of the hydrocarbon vapours; the little that is formed being deposited with the tar. The percentage of sulphur compounds is low, the sulphuretted hydrogen not being broken up in leaving the retort. An increased volume of tar and liquor of improved quality is obtainable, likewise an increased yield of gas per ton of coal.

The coke is dealt with by a telpher plant. The coke from the retorts is discharged into special bottom-opening skips of about 1½ tons capacity, capable of taking the discharge from four retorts simultaneously. The skips are taken by electric telpher to the screening plant, which grades the coke into any desired size, and delivers it into storage bunkers, whence it is loaded by gravitation into railway waggons. The telpher machine is of Messrs. Strachan and Henshaw's free-swivelling, double-bogie type, complete with hoisting and travelling motors, controller, emergency switch, collector trolley, cabin, &c. The lifting capacity is 3 tons at 60 feet per minute; and the travelling speed about 500 feet per minute.

The visit proved highly enjoyable and very instructive. The company saw the coal being elevated to the top of the retorts, and the specialized methods for its distribution; and the system of carbonization and the extraction of the various products, and their disposal, were clearly explained.

Tar-Distillation Plant.

The Dundee Gas Commissioners are also erecting a tar distillation plant at Carolina Port, about a mile from the gas-works; and though time did not permit a visit to the place, a full description of the system was given. The tar will be pumped from the gas-works to the distillation works, and there emptied into a receiving tank capable of containing 56,000 gallons. Then it is to be pumped into the preheaters, about 100 yards away, where the water and light oils will be separated. It will afterwards be run into the main still, where all the various fractions of oils are to be taken off till the tar reaches the pitch stage. At this point it will be run into the pitch cooler; and after being cooled down sufficiently, it will go to the pitch beds, where all arrangements are to be made for loading it into waggons.

After distillation, the vapours given off will circulate round the condensing coil in the preheaters, so as to remove the water. Any light oils that may be in the water will come to the surface and be drained off. As the water will contain a percentage of ammonia, it will be taken back to the gas-works. The heavier oils are to be run off into settling-out tanks.

It is only intended at the present time to deal with the fractions, but after some experience of the work the department may go in for fractionating the light oils, so as to separate the toluol and the benzols and light naphthas.

The whole plant, which is very complete and up to date, includes two 25-ton stills. The total cost of the present installation is about £5000; but sufficient ground has been secured to provide for any extensions thought necessary in the future.

At the conclusion of the visit the company were entertained at tea by Mr. Yuill; and before leaving they expressed their very heartiest thanks for the kindness which they had received.

German Welsbach Company.—According to a report in the "Journal für Gasbeleuchtung" for the 23rd ult., the German Welsbach Company have declared dividends in respect of the year 1913-14 of 25 per cent. on the founder's shares and of 5 per cent. on the preference shares. The net profit on the year's working was 5,264,288 marks (about £263,214), compared with 8,627,159 marks for the preceding twelve months. The report states that the principal departments of the Company have been unfavourably affected by the war—especially through the interruption of export to several important countries. The general meeting of the Company was fixed for Nov. 30.

SOME NOTES ON TAR DEHYDRATION AND BENZOL RECOVERY.

By Robert Barr, Jun., of Kilmarnock.

[A Paper Read before the Scottish Junior Gas Association, Western District, Feb. 6.]

It is my intention in this paper to give such experience on the subject as I myself have gained on the plants which are in action where I am concerned; and I purpose at the outset to divide it into three sections—viz., laboratory work; general description and working of the plants; costs, &c.

In the first place I may mention that the plants under review are meant, in the case of the tar dehydration plant, only for the preparation of tar to conform to specifications as laid down by the Road Board, and in the case of the benzol plant only for the recovery of benzol, solvent naphtha, and the residual oil.

In dealing with the tar, it is necessary for me to explain that road surveyors and others concerned in the repair of roads want a class of tar which is in conformity with the recommendations of the Road Board; and during the season when roads are undergoing repairs, a very good market can always be found for tar from which water, ammonia, and light oils have been removed. Considering the present market value of crude tar, there is not the least doubt that the refining of the tar where it is produced—and this being done by some simple means such as I shall describe—is a revenue producing item in the gas-works which is certainly worth considering by the engineer.

The tar dehydrating plant erected in Kilmarnock by the Chemical Engineering Company, of Hendon, has been in operation for over eighteen months, and the plant for the treatment of oil recovered from the tar some six months later. It is my purpose to give some of my experience with these plants.

The Road Board's Tar Specification.

The tar as recommended by the Road Board under specification for Tar No. 1 is as follows:—

The specific gravity of the tar at 15° C. shall be as nearly as possible 1·19; but in view of the great variation in specific gravity of the tars produced in various parts of the country, the specific gravity may be as low as 1·16 or as high as 1·22.

The tar shall be commercially free from water—*i.e.*, it shall not contain more than 1 per cent. by volume of water or ammoniacal liquor, which water (if present) shall not contain more ammonia, free or combined, than corresponds to 5 grains of ammonia per gallon (70 milligrammes per litre) of the tar.

On distillation the tar must yield below 170° C. not more than 1 per cent., and between 170° C. and 270° C. not less than 16 per cent., and not more than 26 per cent. of distillate (exclusive of water); between 270° C. and 300° C., not less than 3 per cent. and not more than 10 per cent. of distillate.

The distillate between 170° C. and 270° C. (middle oils) shall remain clear and free from solid matter (crystals of naphthalene, &c.) when maintained at a temperature of 30° C. for half-an-hour. This requirement is waived in the case of tar supplied direct from gas-works.

The distillate between 170° C. and 270° C. shall not yield to caustic soda solution more crude tar acids (phenols) than is equivalent to 3 per cent. by volume of the tar.

The free carbon shall not exceed 16 per cent. of the weight of the tar.

The specification for Tar No. 2 is on somewhat similar terms.

The specific gravity of the tar is recommended to be as nearly as possible 1·21, but to be not less than 1·18 or higher than 1·24 per cent.

There shall be no distillate below 140° C. nor more than 3½ per cent. up to 220° C.; between 140° C. and 300° C., it shall not yield less than 15 per cent. nor more than 21 per cent. of the weight of the tar.

The free carbon shall not exceed 18 per cent. of the weight of the tar.

Laboratory Work.

The laboratory work in connection with the above tests is most interesting, and can be carried through for all practical purposes by anyone whose knowledge of chemistry is only very elementary; while the apparatus required is not very expensive. It is therefore with this object in view that I shall deal with the tests.

The specific gravity of the tar can be taken by means of a Lunge hydrometer. Although not so accurate as by the Westphal balance, if carefully manipulated it serves the purpose, and is obviously much more rapid.

The fractionation test can be effectively carried through in the following manner: 500 cc. of the tar under examination is placed in a flask which has a side tube; and a thermometer with a sufficiently high range is inserted into the neck of the flask so that the bulb is opposite the side tube. To the side tube is connected a condenser; and with a rose burner the apparatus may be said to be complete. Other details will occur to the operator, but a little practice will soon enable him to carry out successfully the tests.

Heat is applied very gently at the first, gradually raising the temperature up to 170° C., collecting the distillate [which, if present, shows that the tar is not properly dehydrated] into a receiver

or a graduated measure, when the volume of the distillate, which will consist of water and light oils, can be separately read off; the water separating to the bottom of the measure. Any water thus collected can be tested for ammonia by direct titration with standard acid, and the amount calculated in terms of grains of ammonia per gallon of tar.

The distillation is continued, and the temperature raised to 270° C. About this stage of the test, it is advantageous to stop the supply of water in the condenser, allowing it to become warm. This prevents the naphthalene which distils over at this temperature to block-up the delivery tube from the condenser. The distillate is collected and measured while liquid. Distillation is further continued until the temperature has reached 300° C., and the resultant products measured.

The test for phenols is a very simple matter compared with the recommendations of the previous specification of the Road Board, in which a long and tedious test had to be made to estimate the grains of phenoloid bodies per gallon. It is now only necessary to treat the distillate between 170° and 270° C. with 25° Twaddel caustic solution, collecting the bottoms in a measure and treating with strong sulphuric acids, when the tar acids will separate and can easily be read off and calculated to percentage by volume of the tar.

The Road Board recommend that the estimation of free carbon be determined by complete extraction of the bituminous matter from a weighed portion of the tar by benzol and bisulphide of carbon. This test is a little more difficult, and occupies some time; but it can be effectively carried through in the following manner.

First prepare tarred filtered paper and place in a funnel which is fitted in a Woulfe bottle and connected to a vacuum or filter pump. Next take a sample of the tar to be tested in a small flask and take the total weight. Then pour about 5 grammes of tar into the filter paper above described, weigh the beaker and tar. The loss in weight represents the tar taken for the test. Now start a slight pull by means of the filter pump on the Woulfe bottle, and pour a small quantity of benzol on the top of the tar in the filter, repeating this several times. Next fit up a Soxhlet extractor, as used for the sulphur test, and place a quantity of benzol in the bottom of the flask. Then insert the filter paper and residue into the Soxhlet extractor and start distilling, continuing until the distillate in the side tube is coming clear. [It often requires a second quantity of benzol before a clear distillate is obtained.] Next remove the benzol and replace it with carbon bisulphate, and distil, as above for about two hours. By this time all the tarry matter will have been extracted, and the free carbon only will remain in the filter paper. Take the filter paper and carbon, place it in a water bath and dry, then weigh, and deduct the weight of the filter paper. The result is the carbon in the actual tar taken. Then calculate to percentage.

I have avoided elaboration in these tests, and I omit the test for benzol, as this would take too much space and time. It seems to me that the technical side of this subject could make sufficient material for a paper by itself.

Tar Dehydration and Benzol Recovery Plants.

The author described, by the aid of diagrams, Wilton's patent tar dehydration plant,* as also the benzol recovery plant he used—designed for small works, particularly in conjunction with tar-dehydration plants for working-up the crude light oil or naphtha.

Costs, Profits, &c.

This brings me to the last stage of my paper—costs, profits, &c. In our case the whole production of tar has not been so far treated, owing to our lack of storage accommodation for crude tar. But this has now been remedied by the erection of a large storage tank, into which the tar is pumped direct from the tar and liquor well as soon as it separates. The storage tank (having a capacity of 240,000 gallons) is of ample size to store a full year's make of tar; and as the bulk of the prepared tar for road repairs is used in the summer and autumn months of the year—this being the time when our tar production is at its smallest—our winter make may be stored for summer consumption. Hence the reason for a large storage tank.

For the above reasons I am unable to give actual figures. Basing our calculations on the results that have been obtained, however, I shall endeavour to say what could be done assuming that our total production of tar was treated. In 1913-14 the total tar produced amounted to about 237,000 gallons, the average specific gravity of which would be about 1·13. To bring this tar to the specified specific gravity and complete the removal of the light oils, it is necessary in our case to maintain a temperature between 190° C. and 200° C. in the plant. Consequently something more than light oil and water is distilled over. In fact, the distillate, inclusive of water, is invariably about 14 per cent. of the crude tar; so that this figure of 14 per cent. is the basis of the following calculations.

The 237,000 gallons of crude tar at (say) 15s. per 100 gallons amounts to £1777 10s. Against this we have 203,820 gallons of dehydrated tar at 25s. per 100 gallons, which amounts to £2547 15s. From this has to be deducted labour costs, fuel, depreciation, interest on capital, &c.

The labour costs work out about 0·048d. per gallon. Therefore working the above quantity of tar would cost £47 8s. The fuel used is coke breeze; and pricing this at 5s. per ton, the cost works out at 0·02d. per gallon. So that less than £20 will pay for fuel. As regards the steam used for the plant, I have estimated £25, which includes the proportion of labour charges.

We have now to consider depreciation, interest on capital, and sinking fund charges. The cost of the tar plant, complete with foundations, roof, tanks, pump, &c., amounted to something like £600, and the large storage tank cost £1500. Allowing 7½ per cent. on both for interest, depreciation, &c. (which figure is quite ample), we have a cost of 0·16d. per gallon, which, on 237,000 gallons, amounts to £157 10s.

There is yet a further deduction to be made—the cost of casks and tank for delivering the prepared tar; and I have estimated this at £30.

Assessing these figures all together we have now to deduct from £2547 15s.—the figure for the dehydrated tar—the sum of £279 18s., which leaves a balance of £2267 17s., representing the amount obtained for the tar. Now from the £1777 10s.—the sum representing the price of the crude tar—I deduct the cost of pumping, labour, and fuel dealing with the crude tar. This amounts to the sum of £75, which is a very fair figure; leaving us with a balance of £1702 10s. So that, as against selling the crude tar at this price, we have a balance in favour of the dehydrated tar of £565 7s., which is equivalent to 0·66d. per gallon.

Now it will be remembered that the 14 per cent. of distillate from the tar included the ammoniacal liquor. Of this there is at least 2·5 per cent. which, as previously stated, is run back to the liquor well and utilized in our ammonia plant. There now remains to be dealt with 11½ per cent. of the oils distilled from the tar, and which are treated in the benzol plant already described. It is our practice to manufacture 50-90 per cent. benzol only, as for all we make there is a ready market locally. We also take out the solvent naphtha and the residual oil, which, owing to the higher temperature at which we work our plant, is practically crude creosote oil.

It might be advisable for me at this point to explain, for the benefit of those who have not come in contact with the terms 90 per cent. and 50-90 per cent. benzol, what the figures signify. Well, 90 per cent. is when 90 per cent. is distilled off at 100° C., and 50 90 per cent. when 50 per cent. distils off at 100° C. and 90 per cent. up to 120° C. Solvent naphtha is the distillate between 130° C. and 160° C.

From the 11½ per cent. distillate already mentioned, we obtain 2135 gallons of 50-90 per cent. benzol, which is equal to 0·9 per cent. of the total tar treated. This, at 1s. 3d. per gallon, yields £133 8s. 9d., and about 8000 gallons of solvent naphtha, priced at 9d. per gallon, equals £300. There is also 21,000 gallons of residual oil, which we can sell locally at 3d. per gallon, giving us £262 10s. We have now a total of £695 18s. 9d., from which falls to be deducted labour costs, washing material (such as acid and soda), depreciation, &c.

The labour costs work out at something like 0·32d. per gallon of finished oils, which amounts to £41 12s. For caustic soda and sulphuric acid I have reckoned on £71 18s. to cover the washing of the oils, which is undoubtedly a generous figure. This works out at 0·52d. of the finished oils. There is also the steam and the proportion of labour charges that must be considered; and I have calculated that this will amount to £15. Finally, we have to consider the depreciation, interest on capital, &c., on the plant, which, complete with foundations, &c., cost £200. Assessing these at 7½ per cent. we have £15; making a total of £153 10s. to deduct from £695 18s. 9d.; and leaving a balance of £542 8s. 9d. in favour of working-up the oils ourselves.

Summarizing these items in the following manner will enable you to see at a glance what can actually be done.

203,820 gallons No. 1 tar at 25s.					£2547	15	0
2,135	,,	50-90 per cent. benzol, at 1s. 3d.			133	8	9
8,000	,,	solvent naphtha at 9d.			300	0	0
21,000	,,	residual oil at 3d.			262	10	0
					£3243	13	9
Less cost of labour, tar, and benzol plant			£89	0 0			
Do.		washing material	71	18 0			
Do.		depreciation, &c., tar and benzol plant	172	10 0			
Do.		casks and tanks	30	0 0			
Do.		fuel and steam charges	60	0 0			
					423	8	0
					£2820	5	9
237,000 gallons crude tar at 15s.			£1777	10 0			
Less cost of pumping and fuel			75	0 0			
					1702	10	0
					£1117	15	9

DISCUSSION.

The Chairman (Mr. David Fulton, of Helensburgh) said that they had had an interesting and instructive paper on a subject which was entirely new to the Association; and they were greatly indebted to Mr. Barr for coming forward with it.

Mr. David T. Marwick remarked that the subject was one of peculiar interest to him, because he had been carrying out one or two tests on the matter at Dawsholm. He was pleased with all Mr. Barr had said regarding the dehydration of the tar. One certainly needed to watch the quality of the tar for the Road

* An illustrated account of the construction and working of this plant appeared in the paper read by Mr. C. H. Webb, M.Sc., at the meeting of the Midland Association of Gas Managers in November, 1913—See "Journal," Vol. CXXIV., p. 505.

Board. The ordinary man only seemed to want quality of gas; whereas it appeared to him that the tar paid better. He thought the process as explained by the lecturer was good for medium-sized works; but he was doubtful of its application to works of other sizes.

Mr. GEORGE TAYLOR (Plean) said that, with regard to the test described for carbon in the tar, he did not think it a good one, because the benzol and carbon bisulphide, he found, coagulated the tar more or less, and prevented good separation of the fixed carbon. He thought Mr. Barr should try the Kraemer and Spilkas method, and he would get good results. There was nothing very special to remark about the dehydrated tar; but it was his opinion that the question of the loss in the washing of the light oil was more important than the lecturer had made it out to be. In small plants, they could lose up to 20 per cent., apart from the difficulties of washing. He also thought the method of washing the light oils obsolete. He would like to ask if Mr. Barr had worked his still with the wet steam on all the time. What difference did this make in the working of the plant, and what difference did it make in the refractionating? He (Mr. Taylor) found that a little wet steam on all the time was an advantage. If people were not going to keep a bigger still than 300 gallons, it was not worth putting one up at all.

Mr. WALTER GRAFTON (Glasgow) criticized the financial side of the paper; remarking that Mr. Barr, in making out his gain, had not taken everything into consideration. How many tons of coal were carbonized to get the quantity of tar? Toluol was in great demand just at present by the Government. Mr. Barr had shown nothing in his figures for supervision and stand-by charges.

Mr. STEWART (Glasgow) appreciated the truth of the paper. Every member of the Association who heard or read it would go in for the tar-recovery process to make money. He, also, would remark that the question of supervision and oncost had not been included in the figures given.

Mr. FRAZER (Dalmarnock) wished to know how many men were employed on the tar plant, and how many on the benzol plant. How did Mr. Barr arrive at the amount of tar he received from the retort-house? Had he an actual measurement for his tar, or was it an approximation?

Mr. FULTON, concluding the short discussion, said there was one thing fairly obvious. It would pay almost every gas-works to make Road Board tar. Each gas-works had a market in its own district. There were hardly any roads now in the country that were not using it. Even a distillation plant which only distilled off the light oils did not cost very much. He thought Mr. Barr had been led into error in his figures, owing to present conditions. A figure given, of 15s. per 100 gallons, for crude tar was not a representative figure. It was one brought about by the present conditions of European affairs. Mr. Barr gave them the selling price of 50-90 per cent. benzol as 1s. 3d. Benzol was higher now than it would be in normal times; and 1s. 3d. was a good price. The figure before the war was something like 11¼d.

Mr. BARR, in reply, said, with reference to the remarks of Mr. Marwick, no doubt the Chemical Engineering Company could supply installations proper to the needs and size of the works. As to the toluol, he had only got the length of testing how much was in the tar. They had a big demand for all the benzol they could make; and they considered it worth the trouble when they secured 1s. 3d.

Mr. GRAFTON: Toluol is 2s. 4d. a gallon.

Mr. BARR (continuing) said it would need another rectification still to take out the toluol. Referring to Mr. Taylor's remarks on testing for fixed carbon, the Kilmarnock testing process which he had given them was that recommended by the Road Board. Keeping to the specification of the Road Board, they at Kilmarnock adopted the system; and the surveyors required that it should be done by this method. He found no difficulty in getting good results. There certainly was a loss in washing. It was a small plant, however, and the working of the benzol plant gave little loss if they worked in small quantities. He had taken this loss into consideration. The washing of the light oils was by manual labour—by a man with a ladle. It was laborious; but the man was adequately paid for it. The price of 15s. per 100 gallons of tar was that quoted to them. At the beginning of the financial year, they put out tenders for tar; and this was the price received. The first price quoted had been 13s. Regarding his reason for not including in his calculations supervision and oncost, this, he said, entered into the management side. He had made no calculations as to the amount of benzol recovered from the coal. He took the figures of the actual tar. It would be a simple matter to look up the balance, and see the coal carbonized. Mr. Frazer had mentioned the question of the number of men working the plant. They found it an advantage when they had an order for tar to work night and day, and double-shift the plant. There was so little labour attached to working the apparatus, that it required only attention. One man worked twelve hours, and the other twelve hours; the pay being 6d. per hour. In reply to Mr. Frazer's question as to measuring the tar, it was not an actual measurement, but an approximate one.

Mr. ALEX. WRIGHT (Lockerbie) stated that, without plant, and just allowing the tar to settle, he got 25s. per 100 gallons.

Mr. Barr was awarded a hearty vote of thanks for his paper.

Mr. C. E. Chrimes, of Messrs. Guest and Chrimes, of Rotherham, left estate of the gross value of £282,094.

MANCHESTER JUNIOR GAS ASSOCIATION.

University Lecture on "Town-Gas Engines."

The third, and last, University Lecture of the session 1914-15 in connection with the Manchester and District Junior Gas Association, was delivered last Saturday afternoon in the Inorganic Chemistry Theatre of the Manchester University, by Mr. W. A. Tookey, M.I.Mech.E., of London, the subject being "Town-Gas Engines." There was a very good attendance of members—in point of numbers a record for the session. There were also present several members of the Manchester District Institution of Gas Engineers; the practical character of the lecture apparently appealing irresistibly to the Seniors as well as the Juniors. Most of the principal members of the Association were there, including the President, Mr. J. M'Nicoll, of Warrington, the Vice-President, Mr. W. L. Heald, of Preston, the Junior Vice-President, Mr. S. Carter, of Garston, the Honorary Secretary, Mr. James Bridge, of Stretford, and others of the Council.

The PRESIDENT, in introducing Mr. Tookey, said he had not the slightest doubt that the lecture which was about to be delivered was one which appealed strongly to the majority of the members present, because it was on a subject with which they were dealing nearly every day in the course of their various occupations. The practical character of the lecture was appreciated by the members; and, from this point of view, he assured them that, on the subject of "Town-Gas Engines," they could not find a lecturer more experienced, or more qualified to enlighten them, than Mr. Tookey. They were extremely fortunate in having induced him to come to one of their gatherings. Referring to the proceedings to be held in the evening, the President said there would be an informal discussion on naphthalene subjects, but the members need not devote the whole evening to it, as there were plenty of other topics. They might, for instance, discuss the coal question. This time last year the principal subject that was being discussed was "Coke, and how to get rid of it." This year the all-prevailing topic was "Coal, and how to get hold of it." [Laughter.] The members of the Senior Associations were discussing it; but there was no reason why they, too, should not also deal with it. The excellent gathering was very complimentary to Mr. Tookey, who, if not personally known to them, was at any rate well known by repute.

Mr. TOOKEY then delivered his lecture (illustrated by lantern slides). It will be found on p. 323.

At the conclusion of the lecture,

The PRESIDENT called upon Mr. James Taylor (Mossley) to propose a vote of thanks to the lecturer.

Mr. TAYLOR said he was sure that they were all very deeply indebted to Mr. Tookey for the valuable and most practical information he had given them. On the following Monday morning probably most of them would take the first opportunity of examining their gas-engines. Mr. Tookey had placed some of the Junior Gas Associations under a very great obligation, for he appeared to have devoted himself very largely to their interests. The Manchester Junior Gas Association were deeply sensible of the honour he had done them and the information he had given. He (Mr. Taylor) ventured to think there was not another man in the country who had such an extensive practice in investigating gas engine troubles, and the reason for their unsatisfactory working. The tables he had shown them on the screen would very well repay the most careful study when they appeared in the "Transactions," especially one in which the lecturer worked out the comparative cost of running gas-engines and electric motors. He was sure all the members agreed that the contribution was a most valuable one.

Mr. J. W. NICHOLLS (Radcliffe), who seconded the motion, said Mr. Tookey's lecture had been looked forward to by the members with a good deal of pleasurable anticipation. His book on "Gas-Engines" and his "Gas-Engine Manual" were, he thought, in the hands of nearly every person interested in gas engineering. The lecture had been historical, commercial, and practical. He (the speaker) did not remember having previously heard a lecture in which these three necessary elements had been condensed into so small a compass. The lecturer had given them some very valuable commercial information in regard to dealing with the opposition of electricity. It was a surprising thing that, while most gas departments had taken steps to deal with the question of the maintenance of gas-burners and gas-cookers, the maintenance of gas-engines had not been so well considered. The matter was, however, now being vigorously taken up.

The vote of thanks having been cordially passed, Mr. TOOKEY briefly returned thanks, and the afternoon proceedings terminated.

The evening meeting was of an informal character, a variety of subjects being discussed.

Under the heading of "Great British Business Institutions'—the story of some of the most widely known of our principal commercial undertakings—the "Financial News" last Saturday gave an account of the rise and progress of the Gas Light and Coke Company, with a sketch of the career of Sir Corbet Woodall, D.Sc., the Governor, and references to the able assistance rendered to him by the General Manager (Mr. D. Milne Watson), the Chief Engineer (Mr. Thomas Goulden), and the Controller of the Sales Department (Mr. F. W. Goodenough).

TOWN-GAS ENGINES.

By A. W. Tookey, M.I.Mech.E.

[A Lecture delivered before the Manchester Junior Gas Association last Saturday.]

Notwithstanding the fact that something like twenty-five years have elapsed since, after the expiration of the "Otto" patent, the modern gas-engine entered upon its period of rapid rate of development, it must be admitted that, generally speaking, a considerable amount of confusion of thought exists with respect to many matters of moment which have a peculiar interest to gas engineers. For example, a comparison of the explanatory matter forming a part of the catalogues issued by gas-engine manufacturers can hardly be deemed corroborative one with another in respect of statements as to power developed and gas consumed with varying calorific values of town gas. From some it would appear as if the power of an engine were entirely dependent upon the quality of the gas; whereas actually it depends quite as much upon the quantity of air admitted per cycle, or, in other words, upon the mixture strength.

In a somewhat similar manner, it is generally accepted in technical works that the mechanical efficiencies of a gas-engine at full load is independent of the mean pressure acting upon the piston, and that variations in the value of this ratio of full-load mechanical efficiency, when these occur, are true and proper signs of inaccurate indicator diagrams on which such calculations must perforce be based. Actually the mechanical efficiency at full load does vary with the mean pressures obtained per impulse; for it stands to reason that an engine of certain cylinder dimensions and speed must give a varying proportion of output as brake horse power according to the increase or decrease of mean pressure, while the friction of its working parts remains unaltered. Therefore an engine operating at (say) 85 lbs. per square inch mean pressure and at 85 per cent. mechanical efficiency would mean that the effective or brake horse power mean pressure would be only $85 \times 0{\cdot}85$, or 72 lbs. per square inch; the difference of 13 lbs. (actually 12·75 lbs.) being absorbed in engine friction. The same engine working at 95 lbs. per square inch indicated mean pressure would give $95 - 13$ or (say) 82 lbs. per square inch brake horse power mean pressure, as the engine friction would be constant, and thus would have a mechanical efficiency of $82 \div 95 = 0{\cdot}865$, or 86·5 per cent. In other words, the higher the indicated mean pressure, the higher the mechanical efficiency, and *vice versâ*.

Again, some confusion of thought exists with regard to compression pressure and its relation to thermal efficiency. It is realized that to obtain a certain compression pressure a definite relation must exist between the volume occupied by the charge before compression and its volume after compression; but it is only very rarely recognized that, whatever the volume ratio may be, the actual compression pressure attained depends upon the volumetric efficiency of the pumping stroke by which the charge is induced to flow into the cylinder. If any undue restriction in gas and air pipes, or insufficient valve area or inadequate duration of valve opening, occurs, the volume before compression is filled with a charge of reduced density, and therefore the ultimate compression pressure is affected; but the volume ratio, and therefore the possible efficiency, is unaffected. In other words, it is the volume ratio that counts, and not the compression pressure.

During recent years I have enjoyed a unique experience in carrying out a very extensive series of tests throughout Greater London, both north and south of the Thames, on behalf of the Gas Light and Coke Company and the South Metropolitan Gas Company. All these tests, numbering over 1000 in all, have been carefully made on identical lines, and have yielded a vast amount of valuable information in respect of the performances of gas-engines served with town gas, both from theoretical and practical considerations. It is my intention to attempt to impart some of this information of more particular interest to those who, while not specially interested in the design, construction, and testing of gas-engines, yet are concerned with the subject in a general way, and more especially in the questions affecting the maintenance and more extensive use of the town-gas engine in connection with industrial undertakings.

It is first necessary, however, to endeavour to clear away confused ideas such as have been referred to, and also others of a more practical character which will be mentioned later, and to seek to establish some definite data with respect to which a clear understanding is imperative.

Engine Power.

First, with regard to engine power. An engine with a cylinder of certain diameter and length of stroke, when running at a certain speed and with the maximum number of ignited charges consequent thereon, will develop an amount of indicated horse power varying with the mean pressure obtained at each impulse. This mean pessure varies (*a*) with the strength of the mixture and (*b*) with the timing of ignition.

As regards mixture strength, it is obvious that some definite standard should exist by which to obtain relative comparisons. Hitherto with gas-engines, the volume in cubic feet of gas admitted, expressed in terms of normal temperature and pressure, has been given as a ratio with that of air, the latter also expressed in terms of normal temperature and pressure sometimes measured and sometimes computed, and with or without observations as to prevailing hygrometric conditions. Similarly with liquid fuel so many pounds of petrol, kerosene, &c., have been recorded as compared with a certain volume or weight, measured or computed, of air. Rarely, if ever, has it been possible to take the recorded observations of any two series of tests and to gain any useful information from comparisons thus instituted, because each experimenter has expressed the mixture strength, even if mentioned at all, in his own non-standard way.

Now there is one outstanding quality in all fuels—solid, liquid, or gaseous—and that is its intrinsic calorific value in terms of British thermal units per cubic foot or per pound; and it is a simple matter to determine how many impulses of an internal combustion engine exactly contain either a cubic foot or a pound, whichever unit the circumstances may decide is best or most convenient for accurate measurement. If, then, the specific volume of a charge can be computed, it becomes an equally simple matter to state that the mixture strength is so many British thermal units per cubic foot of charge whatever the relative proportion of gas, air, and residuals may happen to be.

The specific volume of a charge is capable of close estimation, from the known cylinder dimensions of an engine and from the measured or computed volume of the clearance space within which the mixture, consisting of combustible fluid, air containing oxygen for combustion, and residuals from previous explosions, is ultimately compressed before ignition. It is impossible to state the separate weight or volume of either the residuals or the air, for the heat of the former affects the latter; and all the many methods of computation or estimation hitherto elaborated by numerous professional engineers and scientists are for this reason of little or no value, for the heat of the residual gases is singularly variable, depending upon local circumstances incidental to the site, load, mixture strength, instant of ignition, exhaust valve setting, ratio of expansion, &c.

From the known cylinder dimensions, the volume swept by the piston can at once be expressed in terms of cubic feet. From the terminal compression pressure, as determined from carefully taken indicator diagrams, the ratio r of the maximum volume before and the minimum volume after, compression may be computed from the formula—

$$P \div p = \left(V \div v\right)^n \quad \text{or,} \quad \frac{r}{1} = \frac{V}{b} = \sqrt[1{\cdot}3]{\frac{P}{p}}$$

in which P = terminal compression pressure in lb. p. sq. in. abs.
p = initial " " " " "
V = maximum volume before comp.
v = minimum.
n = 1·30.

As an example, it may be stated that for 100 lbs. (gauge) per square inch compression pressure from an initial pressure of 15 lbs. per square inch the value of $r = 4{\cdot}79$ from the above formula. The clearance volume being 1, the volume swept by the piston must be 3·79. It therefore becomes a simple arithmetical problem to determine the total specific charge volume for any size engine working with (say) 100 lbs. compression pressure, for it will have the same ratio to the volume swept as 4·79 is to 3·79.

Knowing, then, the number of impulses taken by the engine per minute and the number of cubic feet or pounds of combustible consumed per minute, it is, again, a simple matter to know that so many impulses have been obtained per cubic foot or pound, and thus, having already determined the specific charge volume, it can be stated that 1 cubic foot or 1 lb. of combustible has sufficed for so many cubic feet of charge. In this way, the calorific value of the combustible being known, the mixture strength of the charge, whatever its composition, can be standardized as being so many British thermal units per cubic foot of specific charge volume.

From a very considerable number of tests carried out in the course of the extensive survey already mentioned, and from computations made upon recorded test results published by various authorities, I find that there is a very definite relation between the mixture strength based on specific charge volume as above explained and the mean pressure generated by each impulse of an internal combustion engine, irrespective of the nature of the fuel employed, but dependent upon the clearance volume ratio r, because it has been already abundantly proved by the theory of thermo-dynamics that thermal efficiency increases with r, and, upon the mixture-strength basis just explained, more combustible must be present to vivify the proportionately larger clearances that low compression pressures involve to the same mixture strength as would exist in a high compression engine with a smaller compression space but similar cylinder dimensions. This was fully explained during the discussion of my paper read in January, 1914, to the Institution of Mechanical Engineers.

By the lessons taught as the result of such comparisons of mixture strengths with mean pressures, it seems abundantly clear that highest thermal efficiencies, according to compression pressure or clearance volume ratios, are obtained from charges possessing a mixture strength not greater than 45 B.Th.U. per cubic foot of specific charge volume, to a large extent irrespective of cylinder size, volume ratio, or combustible, but dependent, as before stated, upon ignition timing.

Take, for example, five various compression pressures over a range indicative of the gradual trend of general practice since the early days of the gas-engine. The results to be expected may be

tabulated thus, when mixture strength of 45 B.Th.U. per cubic foot, on the Tookey basis, is used as a maximum.

Volume ratio r . . . . . =	3	4·1	4·8	5·4	6·3
Compression pressure lbs. per sq. in.	50	80	100	120	150
Thermal efficiency, I.H.P. basis . .	·20	·28	·31	·335	·36
Tookey factor $\frac{\text{mean pressure}}{\text{mixture strength}}$.	1·6	2·0	2·1	2·2	2·3
Mean pressure, lbs. per sq. in. . .	72	90	95	99	103·5

Every practical engineer who is accustomed to test all kinds of internal combustion engines will recognize that the mean pressures thus calculated do in fact apply to the various types mentioned, varying from the low compression (50 lbs.) gas-engines of 24 years ago, the medium compression engines of 15 years ago, to the modern gas-engine of to-day, as well as the Diesel engine. Similarly it will be recognized by those who have specially studied thermal efficiencies practically achieved, that the figures quoted in the table are representative of those recorded by various authorities from time to time, and published in standard works in reference to engines working under full-load and best conditions.

Let me now add another line to represent the number of pounds of indicated mean pressure absorbed in friction [on the basis mentioned earlier—viz., 12·75 lbs. per 100 lbs. mean pressure] by four-cycle, single-cylinder, and horizontal gas-engines.

Compression pressure	50	80	100	120	150
Friction equivalent, lbs. per sq. in. .	17·7	14·2	13·4	12·9	12·3

Deducting these values from the indicated mean pressures the relative brake horse power mean pressures become—

B.H.P. mean pressures, lbs. per sq. in.	54·3	75·8	81·6	86·0	91·2
Representing mechanical efficiency .	·75	·84	·86	·87	·88

The figures that have thus been obtained will also be recognized by those concerned with engine rating as being roughly in correspondence with the variations of practice during the developments that have taken place in the last 24 years, as regards maximum horse power rating for town-gas engines.

Taking the 120 lb. compression engine as being representative of present-day practice, it is usual to rate this at (say) 95 lbs. per square inch indicated mean pressure for constant work, and thus the rated brake horse power is based on 81·6 lbs. per square inch. Now it can be proved that the quotient of 229·1 divided by mean pressure represents the number of cubic feet per horse power per minute displaced by the piston on operative or working strokes, and therefore it can be said that $229{\cdot}1 \div 81{\cdot}6 = 2{\cdot}8$ cubic feet must be displaced per minute per brake horse power of whatever size the engine may be. Suppose, for instance, an engine with a 10-inch diameter cylinder by 18-inch stroke runs, firing every cycle, at 250 revolutions per minute, then it may be computed that the constant brake horse power rating would be $\frac{78{\cdot}54 \times 18 \times 125}{1728 \times 2{\cdot}8} = 36{\cdot}5$.

It is sometimes considered that the indicated mean pressures—the basis of all horse power rating—vary with the size of cylinder. It certainly is not advisable to calculate upon such high indicated horse power mean pressures as 95 lbs. per square inch in large single-cylinder engines; but experience has shown that this can be obtained in every-day work with town gas throughout the range of sizes of one particular maker from 4½-inch to 17-inch cylinders, as proved by indicator diagrams taken during the survey to which reference has already been made.

This value of mean pressure has, however, been the result of properly timing the ignition to suit the mixture strength, as the earlier the ignition occurs, due to wear of operating mechanism, the weaker the mixture has to be, in order to avoid harmful pre-ignitions, and consequently the less load the engine is able to carry, because the mean pressure is directly affected. With unduly rich mixtures a similar state of affairs exists as combustion proceeds before the crank can receive a turning effort; and even though the ignition may be delayed to prevent early firing, yet combustion, once started, takes the form of excessively rapid explosion, causing thumping and waste of power with incomplete combustion.

It is with a full knowledge of the very considerable assistance that the determination of mixture strength on a standard basis gives to those engaged in internal-combustion engine problems that has prompted me to refer to it at such a length. It is impossible to deal with the matter fully; but probably enough has been said of interest and instruction on this most important matter.

Gas Consumption.

Having said so much with regard to power, I now propose to deal briefly with one or two matters connected with gas consumption. In the table already given, the practical, not theoretical, thermal efficiency on the indicated horse power basis has been noted for gas-engines of different compression pressures. These are repeated below with other figures representing the number of cubic feet per indicated-horse-power hour thereby inferred, basing the rate of consumption upon a gas of 500 B.Th.U. per cubic foot. This figure is selected as the approximate calorific value of gas distributed by the greater portion of London and other gas undertakings.

Compression pressure	50	80	100	120	150
Thermal efficiency per I.H.P. . . .	·20	·28	·31	335	·36
B.Th.U. per I.H.P. per hour . . .	12,700	9100	8200	7600	7100
Cubic feet, 500 B.Th.U. gas . . .	25 4	18·2	16·4	15·2	14·2

It will be seen at once how greatly the development of the gas-engine has reduced the rate of gas consumption, due to the increase of compression pressure, during the last 24 years. On the basis of the mechanical efficiencies before tabulated for each compression pressure, the following shows the relative brake horse power hour consumption of 500 B.Th.U. gas at full, three-quarter, half, and quarter loads.

Compression pressure	50	80	100	120	150
Cubic feet per B.H.P. hour, full load.	33·9	21·7	19	17·5	16·1
,, ,, ,, ,, ,, ¾ ,,	36·3	22·7	20	18·25	16·8
,, ,, ,, ,, ,, ½ ,,	42 0	24·9	21 9	19·7	18·0
,, ,, ,, ,, ,, ¼ ,,	58·6	31·5	27·3	24·4	21·8

Taking the 120 lbs. compression engine as representing modern practice, and assuming town gas is available at 20d. per 1000 cubic feet, the above table shows that 1 B.H.P. delivered to the driving belt costs from 0·35d. to 0·49d. per hour, according as the engine happens to be working at full or quarter load respectively. Even at quarter load output it can be seen that a modern gas-engine can work double the time that an electric motor of the same capacity and at the same load can do, at an equivalent cost, when current is available at 1d. per unit—as a flat rate, and irrespective of minimum number of units consumed per quarter, hours of running, or other bases upon which cheap electric power rate can only be obtained in many manufacturing districts.

The competition of the electric motor during recent years has in some cases operated against the small gas-engine; and where any saving of working expenses has resulted from the substitution of gas by electric power, it is usually found that comparisons have been made upon the comparatively high consumptions of old-type low compression gas-engines, which, as shown in the above table, consumed at half load [probably the normal or mean output taken from the engine] twice as much gas per brake horse power delivered as is required by gas-engines of the modern designs. Apart from cost of operation, however, it was clearly shown by Mr. Hiller, of the National Boiler Insurance Company, in his recent presidential address to the Manchester Association of Engineers, that small gas-engines, up to 14-inch cylinders, are much less likely to breakdowns than either steam-engines or electric motors. This undoubtedly is a matter of vital importance to small manufacturers for which the gas industry caters.

The figures I have tabulated represent those which can be expected when gas-engines are kept in proper trim. Having shown what may be done, I now propose to mention other and practical points upon which some confusion of thought exists, with a view to indicating how these figures can be attained and maintained in every-day operation.

In many factories it appears to be accepted as a fact that, according to the load upon an engine, the gas cock requires adjustment to admit more or less gas. This is quite an erroneous idea. According to the timing of ignition, as decided by the engine mechanism—whether hot tube or magneto gear—there is but one strength of mixture coincident with economical running, or, rather, one should preferably say with a fixed ignition point there is a very limited permissible range of mixture strength for economical working. [To illustrate this, the lecturer threw a series of indicator diagrams on the screen.]

Another diagram has been prepared from three indicator cards, taken, as were the previous examples, from one and the same engine, representing the changes brought about in a gas-engine diagram when, with a constant mixture strength, the time of firing is altered mechanically by a change from "start" to "work" position of a magneto operated by a pin projecting from a disc on the cam-shaft, and therefore not adjustable in the true sense of the word. [The lecturer explained the diagram.] This shows conclusively that temperature conditions of the cylinder cannot be disregarded when "tuning-up" gas-engines. This lesson is brought home with added force by studying two further diagrams. Both are from the same engine, using the same mixture strength and the same fixed ignition-point. Soon after starting, ignitions at the rate of 31 per minute resulted in 65·5 lbs. mean pressure, which increased to 77 lbs. when the load had risen to 80 ignitions per minute, or roughly three times as much on the indicated horse power basis. It must be understood, however, that once normal cylinder temperatures have been established little or no change in mean pressure takes place as long as the mixture strength and ignition-timing are unvaried.

It is not at all uncommon to find that the effects of wear upon the timing mechanism of fixed-point igniters produces early firing; and many engines which work noisily, and are thought to be suffering from slack pistons and worn liners, are really merely in need of adjustment of ignition timing. Indeed, I have encountered not a few instances when, a new liner and piston having been recom-

mended and fitted, the piston "blowing" as it has been termed was as pronounced as ever after the work had been completed; proving that a wrong diagnosis had been made by the engineer whose advice had been sought and acted upon.

A pre-ignition diagram was reproduced, in the upper portion of the next slide, shown in full lines; dotted lines being added of a normal "card" for purposes of comparison. The diagram was obtained from an engine fitted with an open tube—no turning valve being provided; and no doubt the original adjustments on the makers' test-bench before despatch were made with a lower quality of gas than that eventually used. Although very serious differences of pressure are depicted in the upper diagram, yet, owing to the slow movement of the piston near either end of the card, one cannot fully appreciate the differences with respect to their period of prevalence. For this reason both the fuel and dotted diagrams have been replotted in the lower portion of the slide on an equal time basis, and it shows that the duration of high pressure under "pre-ignition" conditions is much longer than normal. All the pressures to the left of the perpendicular shown are in resistance to the rotation of the engine fly-wheel, and therefore a serious cause of waste of energy. But the longer duration of highest temperatures also heats up the piston head very considerably, and so much so that the thin film of lubricating oil with which it is covered is largely converted into vapour, which, rising in the form of blue smoke, excuses the attendant for thinking that the piston is "blowing." There is no doubt that pre-ignition, even when not so pronounced as depicted, conduces to lubricating oil trouble—a source of annoyance alike to gas-engine makers, users, and oil merchants.

I suppose that there is no gas company in the kingdom who have not at some time or other received complaints from engine users of bad gas or lack of pressure. These complaints are usually entirely unfounded; but considerable time and expense is often incurred in proving to the gas companies' satisfaction, if not to that of the consumer, that the troubles laid to this cause must be sought elsewhere. When it is borne in mind that a gas-engine can deal with producer gas of 130 B.Th.U. per cubic foot, and with natural gas at 1000 B.Th.U., when proper admixture of air and ignition timing is made, one can safely say that there is no such thing as bad gas, as the consumer uses the term. The trouble resolves itself into the proper proportioning of air and gas to secure the required mixture strength which can be obtained, as is well known, equally as well in one and the same engine with producer or with town gas, and varying the lead of ignition.

Similarly, when it is remembered that during the suction stroke the gas-engine works as a powerful pump, and can as well draw its charge through all the resistances of a suction producer gas plant as from a town main under pressure, complaints of lack of pressure cannot usually be logically sustained. As long as the service-pipe to the engine is adequate to fill the gas-bag to distension under the repeated depletions consequent upon full load, there should be no trouble due to lack of pressure; and when replenishment of the gas-bag is not so rapid as it should be, the cause usually found for this state of affairs is that the rubber diaphragm has been permitted to become unduly flabby and irresponsive, and very probably leaky. At any rate, nothing more is needed than to note how the bag is affected by the demands made upon it, and particularly whether the anti-pulsating valve usually fitted as an integral part of the device is moving to and fro without sticking, and in such a manner that the inlet orifice is closed when the diaphragm is fully distended, and open more or less when deflated.

Complaints such as have been mentioned are much more likely to be due to the irregular operation of mechanical details or maladjustment. In some cases I have found that the ignition-tube furnace is defective. usually through the accumulation of dirt in the passages of the bunsen burner, and giving insufficient heat to the tube. In others the cause has been traced to mis-firing due to insufficient opening of the gas-cock; the governing mechanism opening the gas-valve twice to every impulse obtained. Obviously, in the first case the ignition-tube must be properly heated by cleaning the burner or renewing the asbestos lining on the inside of the chimney, and in the second case the mixture must be strengthened by the admission of slightly more gas, until each charge is properly and efficiently fired. I have also found that, owing to neglect or misdirected zeal on the part of the attendant, the governor does not get away quickly from the position coincident with a "hit" in a "hit-and-miss" governed engine, with the consequence that a series of "nibbles" of gas are admitted, which pass through the engine unignited and therefore wasted. The remedy for this is to clean properly the governor spindle, its pin and points, and to adjust the "die" so that nibbling is entirely prevented.

I have come across instances where the inlet-valve casings have been permitted to rust in—a sure sign that the attendant has neglected the makers' instructions as to periodical valve grinding. Exhaust-valve covers have been found to be bedding imperfectly on their seats, with the certain result of the erosion thereby caused afterwards preventing an effective jointing being secured until the seating has been restored by use of a special tool. Exhaust-valve spindles have been permitted to become badly worn and to work in an "oval" guide, which with the side stress induced by the fixed contact of the operating lever tends to cause the valve-head to tilt slightly, and thus fails to effect a proper seating. In some cases the wear on the end of the exhaust-valve spindle has been uncorrected or unnoticed until the end of the set-screw on the termination of the lever has eaten its way right into the stirrup-pin.

Another defect involving loss of power and efficiency has been frequently noticed in connection with the neglect to replace worn cams and rollers operating the valve levers. [A slide was shown to illustrate the effect of this neglect.] A worn roller by increasing the original clearance, involves reduced valve-lift with later opening and earlier closing, thereby lessening the period of operation and quantity of charge admitted, while a worn cam reduces the valve-lift still more. It is obvious how such neglect can prejudice good performances. In some engines the cams are fitted on a feather, so as to permit starting under low compression pressures and delayed ignition; and I have found a large number of engines working with the keyway of this cam block badly worn, causing irregular operation by the pounding set up by the back lash induced by the stress consequent upon the opening of the exhaust-valve.

When investigating complaints of bad gas and lack of pressure, therefore, attention should be directed to these matters, as being much more likely causes of irregular running or lack of power in gas-engines.

When in good order, a gas-engine should work steadily and smoothly, without loud bumping and knocking noises. Such quiet working, however, cannot be obtained unless the connecting-rod brasses are properly adjusted from time to time as necessity arises. Slack bearings should not be permitted. Reference may here be made to another source of confusion of thought in respect of the proportion of the power developed by the exploding gases that is exerted upon the crank. It is not a fact that the full explosion pressure is available as a turning effort, as might be deemed to be the case by those who have given no study to the question. Part of the force is absorbed by the inertia of the piston in getting away from the dead-point, while another part of the force generated is transmitted to the main bearings, owing to the fact that the slight angularity of the connecting-rod and crank at such times is unable to divert the major portion of the pressure on the piston as a turning effort on the crank.

It occasionally happens, especially with small gas-engines, that though the general conditions appear to be quite normal, a considerable diminution in power is noticed. In such cases it is advisable to disconnect the exhaust-pipes at the silencer, as the cause will most probably be found in the blockage of the pipe by a thick deposit of carbon which prevents complete expulsion of the products of combustion, and thereby reduces the capacity of the engine for an adequate volume of fresh charge.

Table of Town Gas Engine Power and Consumption.

Volume ratio . . .	r.	3	4·1	4·8	5·4	6·3
Compression pressure .	Pc.	50	80	100	120	150
Thermal efficiency on I.H.P.	Eth.	0·20	0·28	0·31	0·335	0·36
Tookey factor . . . (Mean pressure ÷ mixture strength)	F.	1·6	2·0	2·1	2·2	2·3
I.H.P. mean pressure . lbs. per square inch	Pm.	72	90	95	99	103·5
Friction equivalent . . lbs. per square inch	Pf.	14·0	14·0	14·0	14·0	14·0
B.H.P. mean pressure .	Pn.	58·0	76·0	81·0	85·0	89·5
Mechanical efficiency .	Em.	0·81	0·84	0·85	0·86	0·864
Cub. ft. volume swept by piston per B.H.P. per min. . . . (maximum rating)	Vs.	3·95	3·05	2·8	2·7	2·56
Gas Consumption.						
B.Th.U. per I.H.P. hour at highest thermal efficiency . .	..	12,700	9100	8200	7600	7100
Equivalent cub. ft. per I.H.P. hour with 500 B.Th.U. gas .	..	25·4	18·2	16·4	15·2	14·2
Do. per B.H.P. hour at 1 load . . .	..	31·5	21·7	19·3	17·65	16·45
Em. . .	..	·81	·84	·85	·86	·86
Do., do., at ¾ load . .	..	33·5	22·7	20·2	18·5	17·1
Em. . .	..	·76	·80	·81	·82	·83
Do., do. at ½ load . .	..	37·5	24·9	22·2	19·75	18·7
Em. . .	..	·675	·73	·74	·77	·76
Do., do. at ¼ load . .	..	50·0	31·5	27·3	25·0	22·9
Em. . .	..	·51	·58	·60	·61	·62
Cost.						
Pence per B.H.P. hour at ¾ load . . . (Gas at 2od. per 1000 cub. ft.)	..	0·67	0·45	0·40	0·37	0·34
Equivalent to electric current, pence per unit (85 per cent. motor efficiency)	..	0·76	0·51	0·45	0·42	0·39

Messrs. W. Carr (Stalybridge), J. Taylor (Mossley), W. L. Heald (Preston), the President, and J. W. Nicholl (Radcliffe) subsequently took part in a conversational discussion with the lecturer.

NATIONAL ILLUMINATION COMMITTEE.

Report of the Chairman.

There was held on the 12th ult. an annual meeting of the National Illumination Committee of Great Britain, which is affiliated to the International Commission on Illumination, and constituted by co-operation of the Illuminating Engineering Society, the Institution of Electrical Engineers, the Institution of Gas Engineers, and the National Physical Laboratory. The following is the text of the report that was presented by the Chairman (Mr. Edward Allen).

The past year will have acquired some importance as the first in the history of the National Illumination Committee of Great Britain and of similar organizations in other countries. The work of the Committee has mainly consisted in the establishment of rules and appointment of officers. It is gratifying to know that the representatives of the various interests have been most cordial in their relations, and that the rules represent their unanimous opinion. It is felt that on such a good foundation a goodly edifice will be erected.

The Committee have had under consideration the question of the "Rating of Light Sources in Candle Power or Consumption;" and they have passed the following resolution, which has been transmitted to the Secretary of the International Commission on Illumination:

> It is desirable that a uniform international method be adopted for rating and marking all sources of light. It is recommended by the National Illumination Committee of Great Britain that the matter be considered at the next session of the International Commission on Illumination; and the administration of that Commission is asked to take the necessary steps to bring this resolution to the knowledge of the different National Committees, with a view to their co-operation.

This question will be further dealt with at to-day's meeting.

The Committee considered the report on "Nomenclature and Standards" of the American Illuminating Engineering Society, and appointed a Sub-Committee to draft sets of definitions and nomenclature for consideration by this Committee.

More than a passing reference should be made to the European war and its adverse influence on the international aspect of the work. Although the harmony which has characterized the International Conferences of the past has been destroyed, it will be possible for the various National Committees to make some progress on independent lines, and it is hoped that no considerable period of time will elapse before complete harmony is restored.

Professor Lewes on Motor Fuel.

Next Monday, Professor Vivian B. Lewes, F.I.C., F.C.S., will commence his course of Fothergill Lectures on "Motor Fuel" at the Royal Society of Arts, to which reference has already been made in the "JOURNAL." In his first lecture he will deal with the production, properties, composition, and grades of petrol, its transportation, storage, and distribution, and its calorific value, and inquire how far this is a basis for comparison. In his second lecture (on the 22nd inst.) he will discourse on petrol substitutes, the "cracking" of heavier fractions of petroleum into spirit, and the researches upon which the processes are based. The concluding lecture (on the 1st prox.) will be devoted to "cracked" spirits. Professor Lewes will deal with the effect of degree of employ, the use of water or steam, surface action and its supposed effect, the utilization of gases in solution to increase vapour tension, and the steam-engine *versus* the internal-combustion engine for motor traction. The lectures begin at 8 o'clock.

Society of Engineers.

In the course of his Presidential Address to the Society of Engineers on Monday of last week, Mr. Norman Scorgie pointed out that every branch of engineering has become more intensive and more complex, but municipal engineering has been peculiarly influenced by the aggregation of people in towns, modern methods of transport, and other changes that have revolutionized social conditions within a short time. In these changes municipal engineering has received less help from specialization than other branches; and therefore the municipal engineer must know something of everything, and everything of something, while the value of his work is measured chiefly by increased public convenience and a reduced death-rate, and not by monetary returns. Every young engineer starting in municipal practice should have a grounding in the science of economics. While not expressing an opinion on municipal trading, Mr. Scorgie suggested that the municipal engineer should combat the misleading division of municipal expenditure into productive and non-productive, and endeavour to set up an enlightened public opinion as to the real aims and productiveness of his work. As to whether the present wide scope of municipal engineering was likely to be a permanent condition, he thought there were grounds for suggesting that it might give place to specialization to some extent. He did not think the status of engineering was permanently at the mercy of anything except merit of the engineer; but unqualified men should be debarred from calling themselves engineers.

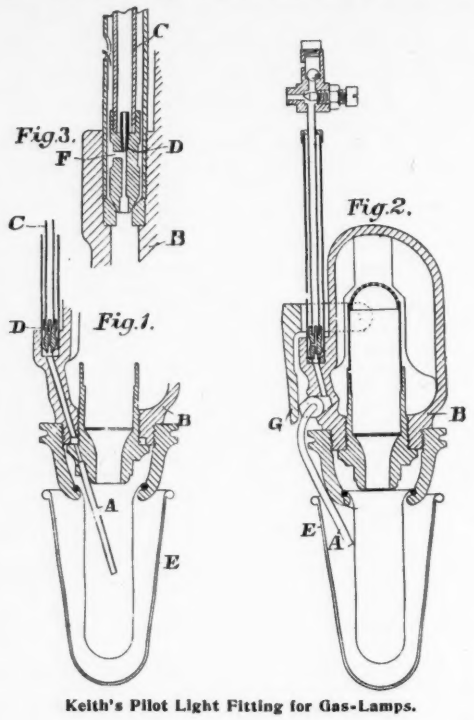
REGISTER OF PATENTS.

Pilot-Light Fittings for Gas-Lamps.

KEITH, J. & G., of Farringdon Avenue, E.C.

No. 9097; April 9, 1914. No. 14,417; June 16, 1914.

This combined invention relates to pilot light fittings for incandescent gas-lamps—particularly high-pressure inverted incandescent gas-lamps (as described in patent No. 14,490 of 1913), with the object of providing a fitting applicable to lamps where the mantle is "closely surrounded by an envelope of refractory material, such as silica."



Keith's Pilot Light Fitting for Gas-Lamps.

The invention is illustrated in two embodiments; and an enlarged view is given of an injector arrangement common to the two constructions.

As shown in fig. 1, there is formed in the lower end of the burner nozzle a downwardly inclined passage into which is fitted a fine tube A (of clay or other refractory material) opening at its lower end directly into the interior of the mantle, which is supported by a cup sustained by the lower end of the heater B for the mixture. The gas supply is led downwardly from the top of the lamp.

Fitted to a tube C which conveys the pilot gas to the tube A is an injector D, provided with a jet of small bore which gives the requisite velocity to the gas for the pilot light. The tube C is passed through a guide tube, the upper end of which projects through the top of the lamp—means being provided for holding the tube firmly downwards, while at the same time permitting the entire tube and injector to be withdrawn for inspection.

When the lamp is burning, there is necessarily an increase of pressure inside the silica envelope E surrounding the mantle, and which increase of pressure, together with the chimney effect of the pilot tube and its connections, prevents the passage of any small leak of gas down to the tip of the pilot tube (while the lamp is burning), which would otherwise rapidly choke the tube "when heated to a temperature sufficient to decompose the gas and form hard carbon." As will be evident from consideration of fig. 3, leakage of gas is free to pass out by way of the lateral orifice F and thence into the guide-tube, whence it passes out at a point in a zone of low temperature—*i.e.*, a zone where the temperature is not sufficiently high to decompose the gas and cause a deposit of carbon.

In practice, it is found, in connection with the construction shown in fig. 1, that there is some tendency for the products of combustion from the pilot light to rise through the nozzle and the heater B and finally through the injector tube of the lamp, and liability to condensation of water in these parts due to the combustion of the hydrogen in the gas. The water of condensation, too, has a very corrosive action on the metal, as will be understood.

With a view to overcoming these drawbacks, the arrangement shown in fig. 1 is modified in that the pilot light, in lieu of burning inside the mantle, is caused to burn outside the mantle, although inside the silica envelope. This modified arrangement shown in fig. 2 is said to satisfy all requirements, as the products of combustion from the pilot jet pass upwards in the normal direction and, in turn, produce a suction effect through the nozzle and injector sufficient to induce the requisite volume of air for combustion.

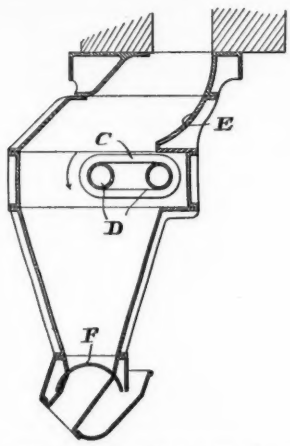
In fig. 2, the pilot or bye-pass tube A is led between the top of the silica envelope E and its supporting ring, being provided at its upper end with a partially spherical enlargement adapted to engage a conical or spherical seat formed in the side of the body of the heater B; the enlargement being pressed lightly on the seat by a swinging hinged weight G so balanced that the lower end tends to swing towards the centre of the heater.

Discharging Vertical Retorts.

DUCKHAM, A. M'D., of Ashstead, Surrey.

No. 17,668; July 25, 1914.

In his specification, the patentee says: The well-known discharging device of the Woodall-Duckham vertical retort comprises a retort extension having a curved side and terminating in a substantially gas-tight hopper, from which the coke is withdrawn by periodically opening a curved water-sealed door [F in the accompanying illustration], and a toothed roller mounted to rotate continuously on a horizontal axis at the foot of the curved side. In one of his systems of carbonization in vertical retorts he applies a constant mechanical pressure to the charge in the retort, so that the discharging roller has to support not only a part of the weight of the charge but also the mechanical pressure. It follows, therefore, that the teeth of the roller have to move against a very considerable pressure, which not only damages them but increases the consumption of power. To avoid this objection, the present invention substitutes for the roller, as a feature of the combination, an endless chain belt travelling over two rollers. In this manner there is obtained the incidental advantage that the necessary supporting surface may be accommodated in a smaller space than is possible when a roller is used.



Duckham's Vertical Retort Discharger.

The illustration is a vertical section (through the bottom extension of the retort and discharge hopper) to illustrate the invention.

The chain belt C extends around the continuously rotating rollers D; its engagement with pins on the rollers causing its upper part to move in the direction of the arrow. Being situated at the foot of the curved side E of the retort extension, it supports some portion of the weight of the charge in the retort, and continuously carries forward pieces of coke from this charge until they fall over the front roller D into the hopper. The chain belt should have a substantially continuous surface, so that its links fit into each other in the manner usual in the construction of underfeed stoking apparatus.

Hydraulic Mains.

DRAKES LIMITED, and DRAKE, J. W., of Ovenden, Halifax.

No. 1308; Jan. 17, 1914.

The patentees proposal is to construct hydraulic mains so that facilities are afforded for cooling the gases passing through them, or reducing their temperature to the desired extent prior to the passage of the gases to other parts of the apparatus for subsequent treatment.

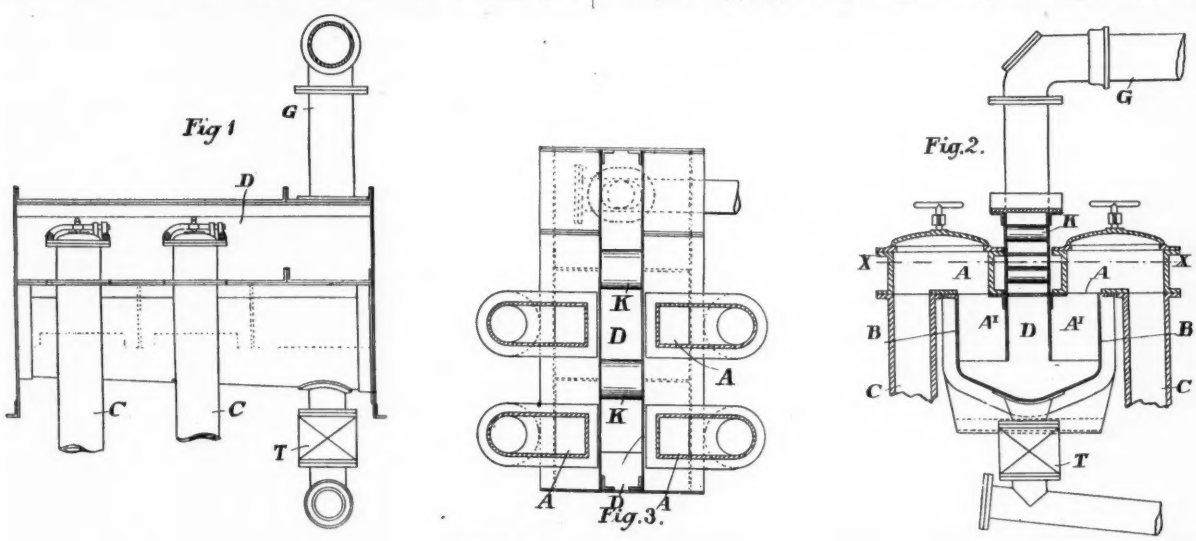
The construction of the main is of such a character as to allow of the formation therein of a cavity common to a series of inlet cavities with the side walls comparatively near each other. Thus they present a relatively large area for cooling the thin or narrow volume of gas; so that it is not necessary to use water-cooled surfaces as already proposed, while the inlets for the gases are separate from each other and conduct the gases from their respective retorts to the main without requiring intervening controlling valves. Thus whether all or any less number of the inlet pipes are in use the main acts efficiently. Further, the construction affords free access to the interior; so that, without interfering with the flow of gas or the working of the main, it may be kept clean or relieved of accumulations of any undesirable matter.

Fig. 1 is a side elevation of the hydraulic main; fig. 2, a sectional end elevation; and fig. 3, a sectional plan on the line X. Fig. 4 is a longitudinal sectional elevation, showing a modification.

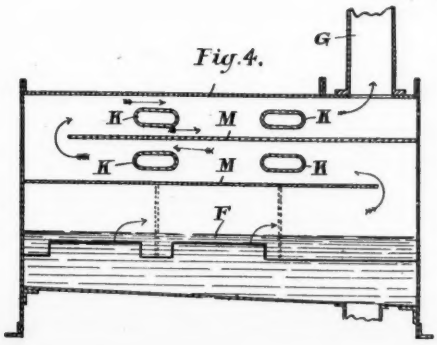
The main is arranged in any appropriate part of the circuit through which the gases have to pass; so that one or more of the dip pipes A may conduct the gases away from the retorts. The dip pipes are of the ordinary type, or else have cavities A^1 formed integrally with the walls B of the hydraulic main; so that each will act as a dip pipe and a sealing chamber for each pipe C leading thereto. In conjunction with the cavities A^1 is formed another cavity D, common to the series and extending above the liquid F, so that suitable space has to be traversed by the gases on escaping from the dip pipes prior to their exit from the main through the exit pipe G. Thus a large surface forming the walls of the cavity D is presented to the external atmosphere "in order to afford means for cooling the gases which come into contact with the inner surface thereof."

The chamber D above the liquid is preferably made comparatively narrow, so that the breadth of the current of gases passing through it is in the form of a comparatively narrow stream; thus causing the gases "to stretch over surfaces of considerable area, which will absorb the heat therefrom, afterwards radiating same to the atmosphere."

To further increase the area of the cooling surfaces longitudinal passages are made through the end walls and through the cavity D, in order that air may circulate through the passage. Or, again, the well-known arrangement of passages K (fig. 4) extending crosswise through the upper part of the chamber D may be arranged, while the



Drakes' Hydraulic Main Arrangement.



baffle-plates M deflect and conduct the gases so that they flow in the direction indicated by the arrows.

When the hydraulic mains have a series of dip pipes A terminating in them, it is preferred to arrange the bottom to slope towards one end, so that the heavier productions of condensation will flow in that direction.

The walls of the chambers A^1 continue beyond the pipes C, in order to form cavities at the end of the main and above the outlet pipe T. These cavities are sealed by the water within the main, so that the gas is prevented from entering. Hence, by removing the coverings above the cavities as occasion may require, access is afforded to enable the attendant to remove any accumulated matter without interfering with the working of the main.

The Winchcomb Rural District Council are applying to the Local Government Board for sanction to a loan of £12,867 for the purpose of carrying out a scheme of water supply to several parishes.

PARLIAMENTARY INTELLIGENCE.

OPENING OF THE ORDINARY SESSION.

The Fifth Session of the First Parliament of the present King was opened by His Majesty on Nov. 11 last, when, as is customary, he read the Speech from the Throne. The unusually early assembling of Parliament was called for by the exceptional conditions prevailing as the result of the outbreak of war in Europe; and after sitting for a few weeks both Houses adjourned over Christmas. The House of Lords had several sittings in January; but the ordinary business of each House was commenced last Tuesday. Next day, the Speaker of the House of Commons laid upon the table a report from his Counsel (Mr. Ernest Moon, K.C.) that he had conferred with the Chairman of Committees of the House of Lords (the Earl of Donoughmore) for the purpose of determining in which House the respective Private Bills should be first considered; and they had decided that the following Bills should originate in the House of Lords:—

Altrincham Gas; Ashington District Council; Brighton and Hove Gas; Frimley and Farnborough District Water; Ilfracombe Gas; Northwich Gas; Ormskirk Gas and Electricity; Plymouth Corporation; Prescot Gas; South Staffordshire Water; Spennymoor and Tudhoe Gas; Sunderland Corporation (Wearmouth Bridge); Sutton Water; Warwick Gas; West Gloucestershire Water; Wolverhampton Corporation Water; Yorkshire Electric Power.

The following Bills are accordingly allocated to the Commons:—

Ammanford District Council; Ascot District Gas and Electricity;* Barnoldswick Water; Bury and District Joint Water Board; Chelmsford Corporation Gas; Dewsbury Corporation; Doncaster Corporation; Lincoln Corporation; Lurgan District Council; Metropolitan Water Board; Rhondda District Council; Skegness Gas; Southend Water;* Weardale and Consett Water.*

All the Commons Bills, with the exception of the Skegness Gas Bill, have been read the first time, and those marked with an asterisk are referred to the Examiner.

The Increased Freightage Rates.

In the House of Commons on Tuesday, Mr. R. H. N. NEVILLE (the Chairman of the Brentford Gas Company) drew attention to the present increased rates of freight, which, he pointed out, affected not only the Government supplies, but those of a large number of people. He said: I would like to ask the Government on what principle they propose to deal with the utilization of the interned steamers, which, we understand, they are now going to offer as tonnage for the various requirements of the coal and food supplies of this country. Before the war, the ordinary freight was 3s.; but quite recently—within the last fortnight or three weeks—freights have gone up to 13s. 6d. The hardship is that most of the suppliers of food, and a very considerable number of those who supply coal, have, in fact, incurred expense on steamers which were carrying on the trade. But as the Government have commandeered the steamers—quite rightly—to supply the food and other necessaries for the Army, the effect has been to put up the price of tonnage to others. The result, of course, is that the price of coal and other commodities has very largely increased. The people who own steamers do not object to the vessels being commandeered, but they think that some consideration should be paid to those persons who are bound under contracts to supply coal to gas-works, water-works, or for the purpose of household distribution. It does seem to them that they ought to have special consideration paid to them, because of being under statutory obligation to supply coal in the way I have indicated. I do think that, when we come to consider the question of taking over the tonnage of German and other ships which are interned, they ought to be treated in a different way, and not left entirely to competition. If I may put an illustration, I would say this: Supposing I had one of the finest motor-cars—a Rolls-Royce—and it was commandeered by the Government, I have to pay, not 10 per cent. which the Government pay, but 400 or 500 per cent. for the car, which I may want for my trade. This is a matter which affects the supply of the necessaries of life to every household in the kingdom. I hope the Government will look at the question from this particular point of view, not only of shipowners, but of consumers. I trust an opportunity will be given to raise and discuss the question of the utilization of the interned steamers. The Government did not take the interned steamers, but they took ours quite rightly, and I do not object to that. This matter involves a difficulty with respect to the coal supply of a large number of people in the Metropolis and other parts of the kingdom.

LEGAL INTELLIGENCE.

BREACH OF A CONTRACT FOR GAS-MANTLES.

In the King's Bench Division of the High Court of Justice last Tuesday, Mr. Justice Rowlatt had before him an action brought by Joseph T. Robin, Limited, gas-mantle manufacturers, of Streatham, against Mr. Solomon Cowan, of West Gatesbead, wholesale dealer in mantles, in respect of a contract. Plaintiffs claimed £111 2s. 6d., the price of mantles delivered by them; and before the Master judgment was entered for them for this amount, but with a stay of execution pending the trial of a counterclaim by the defendant for £342 2s. 6d. for damages alleged to have been sustained by him by reason of a breach of contract by the plaintiffs.

On behalf of the defendant it was stated that by a contract entered into between himself and the plaintiffs in March, 1914, they agreed to supply 470 gross of inverted mantles at 11s. 6d. per gross and 100 gross of Graetzin mantles at 12s. 6d. per gross. The first delivery of 100 gross of the inverted mantles and of 25 gross of Graetzins was to be made on March 15, 1914, and the balance at dates to be furnished by the defendant. In June there were 245 gross of inverted and 75 gross of Graetzin mantles remaining to be supplied. In August plaintiffs refused to deliver the rest of the goods, and repudiated the contract. The defendant now claimed the difference between the contract price and the market price after the outbreak of war in August—viz., £342 2s. 6d.

For the plaintiffs it was argued that it was an implied term of the contract that the defendant should take delivery of the goods within a reasonable time, and that he should pay on delivery. The defendant had not paid for the goods delivered in June, and, it was alleged, had never been able or willing to take delivery of, and pay for, the balance; and the plaintiffs were therefore justified in treating the contract for the undelivered goods as determined.

It was stated by the defendant that he offered to pay the amount due on the June account in the course of an interview with Mr. Robin in August, but was told that it was too late. The defendant's traveller said the price of incandescent mantles had nearly doubled since the outbreak of the war. Mr. J. T. Robin said there was no arrangement with the defendant that he should have credit. At the interview in August he told the defendant that as soon as he paid for the mantles he could have them. The defendant made no offer to pay for them, and he had received no money from him.

His Lordship found that there had been breach of contract by the plaintiffs; and he gave judgment on the defendant's counterclaim for £177 9s. with costs.

Claim in Regard to Death from Gas Poisoning.

In the Companies' Winding-Up Court last Tuesday, Mr. Justice Astbury had before him a case in which the executors of a person insured in the United London and Scottish Insurance Company, Limited (in liquidation), made a claim under a sickness and accident policy. It was specified in the policy that it did not insure against death or disablement by accident directly or indirectly caused to any extent by, *inter alia*, "anything swallowed or administered or inhaled." On April 18, 1912, the assured was found dead in Edinburgh in a house of which he was the sole occupant. His body was in the lavatory, where the gas was turned on, but not lighted. The Company repudiated any liability on the ground that death was caused by "inhalation." Afterwards they went into liquidation; and the Liquidator rejected the claim of the executors of the deceased under the policy, on the same ground. The executors appealed; and the sole point now raised was whether the assured died from gas inhaled within the meaning of the exception in the policy. His Lordship, in giving judgment, said the words in question, if read *ejusdem generis* with those before and after them in the condition, received their full meaning if they were treated as excluding the results of the assured's "swallowing or inhaling" anything, for medicinal or other reasons, which he might believe to be harmless. This construction gave fair weight to the exception, was in harmony with the character of the excluded risks, and did no violence to the general character of the insurance. He thought the Liquidator's decision was wrong, and the claim must be allowed, with costs.

Cardiff Coal Contract Dispute.

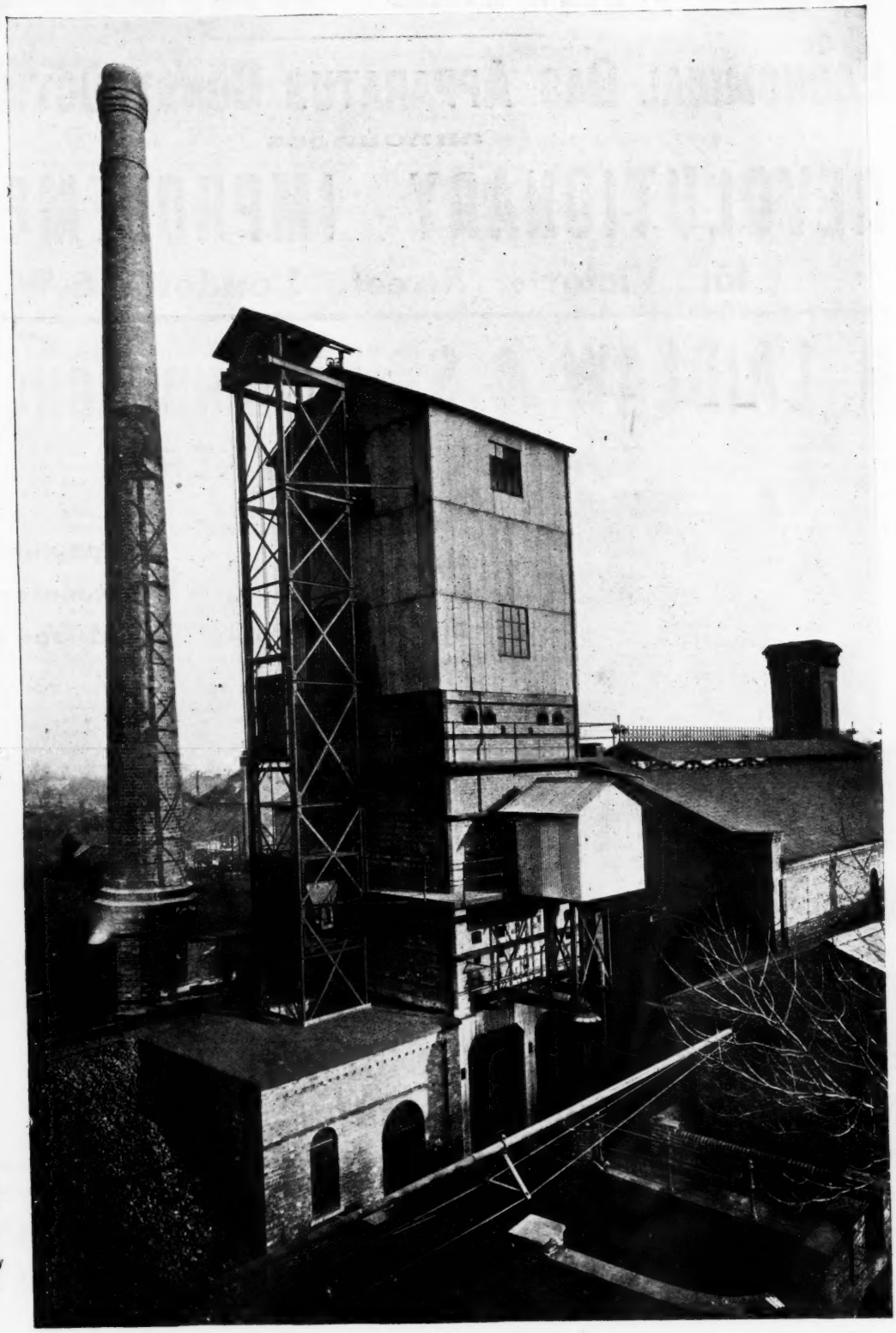
In the Court of Appeal on Saturday, an appeal was heard by the Cardiff Gas Company from a verdict and judgment against them at the Glamorgan Assizes under circumstances which were reported in the "JOURNAL" for March 17 last year [p. 757]. Mr. Thomas Taylor, the plaintiff, who was a colliery owner, contracted to supply the Company with 25,000 tons of coal. In September, 1912, a difficulty was experienced in supplying customers, owing to water having got into part of the mine; and the amount of coal sent to the defendants was below the quantity specified as required. There was also a two-days' strike. The shortage continued from one cause and another till Jan. 31, 1913, when the mine became flooded and the output ceased. The Gas Company thereupon went on the market and bought other coal. Plaintiff claimed payment for coal supplied to January, 1913. Defendants admitted the claim, but counterclaimed some £1100, the difference between the plaintiff's contract price and the market price. The agreement under which the coal was supplied contained a clause that the seller was not to be liable for shortage or failure of supply if due to accidents, strikes, and so on; and the plaintiff alleged that this exempted him from liability. The Jury found that there had been no breach of contract because there had been an accident in January. Mr. Holman Gregory, K.C., and the Hon. Trevor Lewis submitted on behalf of defendants that the proper questions had not been put to the Jury. The question was not whether there had been an accident in January, but whether there had been one in September, when the shortage in delivery first began. They contended also that, as the colliery was winning coal more than sufficient to meet their demand in full, the accident was not one which caused a stoppage in supply. Mr. Bankes, K.C., Mr. Inskip, K.C., and Mr. Rowland Thomas, for the plaintiff, contended there had been no misdirection. The Court held there must be a new taial, as the Jury had not returned a finding as to the shortage of delivery between September, 1912, and Jan. 31, 1913.

Keighley Extensions.—The Keighley Corporation have adopted, by a majority of one vote, the recommendation of the Gas Committee that new carbonizing plant, including retort-benches, steelwork, chimney, bench-bracings, coal-handling plant, coal-hoppers, stoking machinery, and electrical power-generating plant, be installed, and that the tender of Messrs. Drakes Limited, of Halifax, be accepted, at a sum of £21,495; the cost to be met out of revenue. It was pointed out that the work was rather in the nature of a renewal of plant than an extension; and it was calculated that it would effect a saving in working of £2000 per annum, as compared with the old system.

WOODALL-DUCKHAM INSTALLATION AT SPALDING.

Plants Erected and in Course of Erection.

BOURNEMOUTH
POOLE
NINE ELMS
KENSAL GREEN
BURNLEY
LAUSANNE
LUTON
LA GRANGE, U.S.A.
DRESDEN
IPSWICH, Aust.
POOLE (II.)
SMETHWICK
HULL
DERBY, U.S.A.
TOTTENHAM
BUDAPEST
YOKOHAMA
LUTON (II.)
BIRMINGHAM (Windsor St.) (Nechells)
SPALDING
STRANDVEI
HOLYOKE, U.S.A.
BIRKENHEAD
BRISTOL
CLECKHEATON
KINLOCHLEVEN
TOULOUSE
WEST BROMWICH
MARGATE
HYDE
IPSWICH
BOLTON
ABERDEEN
DERBY, U.S.A. (II.)
POOLE (III.)
SMETHWICK (II.)
NICE
WANGANUI, N.Z.
SCHENECTADY, U.S.A.
BROCKTON, U.S.A.
NEW HAVEN, U.S.A.
GREENOCK
AYR
MARSEILLES
MONTBELIARD
DUNDEE
ST. ETIENNE
SOUTH SHIELDS
WALLASEY
KENSAL GREEN (II.)
KENDAL
IRVINE
ROWLEY REGIS
HAMILTON
HARROGATE
TUNIS
BRENTFORD
CANNOCK
PRESCOT
GLOSSOP
WORKINGTON
HULL (II.)
NORMANTON
MESSENA SPRINGS, U.S.A.
BIRMINGHAM (Swan Village)
BRADFORD
MELBOURNE, Aust.
BERGEN, Norway
TRONDHJEM, Norway
ELLESMERE PORT
TOTTENHAM (II.)
PORTSEA ISLAND



Extract from the "JOURNAL" for Dec. 1, 1914.

"Comparing in his report the last half year of the horizontal retort working with the corresponding period of the Woodall-Duckham vertical retort working (when the installation had fairly "got into its stride"), Mr. Wimhurst said that for the six months ended Sept. 30, 1913 (with horizontals), the make of gas was 22,627,000 cubic feet, the coal used 2110 tons, and gas made per ton 10,718 feet. For the half year to Sept. 30, 1914 (with verticals), the gas made was 26,253,000 cubic feet (an increase of 3,626,000 feet), the coal used 2146 tons (an increase of 36 tons), and the gas made per ton 12,233 cubic feet (an increase of 1515 feet). The gain on the first year's working of the vertical plant, over the last year of the superseded horizontal retorts, works out as follows: Decrease in labour costs, £225; increased sales of gas, £446; total, £671. Deducting £265, for interest and loan repayment, there has thus been effected by the new plant a net saving of £406."

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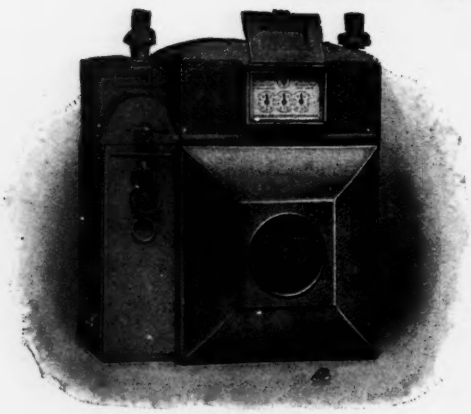

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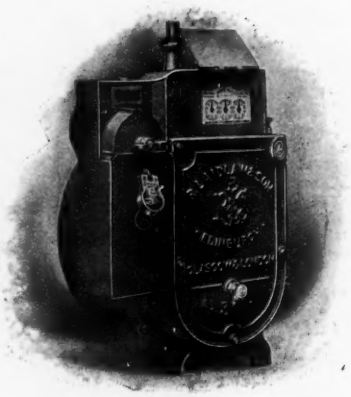

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MISCELLANEOUS NEWS.

THE GAS LIGHT AND COKE COMPANY.

Half-Yearly Meeting of the Proprietors.

The Half-Yearly Ordinary General Meeting of this Company was held last Friday at the Chief Offices of the Company, Horseferry Road, Westminster—Sir CORBET WOODALL, D.Sc., M.Inst.C.E. (the Governor), in the chair.

The SECRETARY (Mr. Henry Rayner) read the notice convening the meeting.

The seal of the Company having been affixed to the "Register of Proprietors," the report and accounts (which have already appeared in the "JOURNAL") were taken as read.

THE GOVERNOR'S SPEECH.

The GOVERNOR: Ladies and Gentlemen,—Your perusal of the report and accounts will have shown you that the past half year of widespread war brought its full share of burdens and anxieties to our Company. Like many individual shareholders, the Company have had to meet increased expenses out of a reduced income. We have shared the load which is being borne by the country as a whole.

COST OF MANUFACTURE.

Various causes due directly to the war, and which I will deal with later, have added greatly to the cost of manufacture; and midway into the half year it became evident to the Directors that the call upon reserve funds in the immediate future would be so heavy as to embarrass the conduct of the Company's affairs. For this reason, it was decided—I need hardly say with much regret—to raise the price of gas by 2d. per 1000 cubic feet, as from the end of September. This is peculiarly a time when we would desire to keep the price low; but it was better to make a small rise now than a heavier one later on.

REDUCED SALES OF GAS.

Among the causes of the diminished profit of the half year is the reduction of nearly 5 per cent. in our sales of gas. This decrease was more than accounted for by the drastic treatment of the lighting of London by order of the authorities, as a precaution against aërial attacks, and by the earlier closing of licensed premises, together with a general tendency to earlier hours during this period of trial and anxiety. The effect on our output of gas of these reductions in the quantity of light and in the hours of burning, is not fully disclosed by the accounts, as, but for these adverse circumstances, we should certainly have had an increase—probably a large one—to report.

POPULARITY OF GAS.

Gas is growing in usefulnesss and popularity in its many applications. The extension of the use of gas-fires and heating-stoves, as well as gas-heated domestic boilers, during the half year was well above the average. The advantages of gas have been strongly illustrated lately. In every direction there have been springing-up temporary quarters and kitchens for troops, emergency hospitals, convalescent homes, clubs for sailors' and soldiers' wives, work rooms for women, factories for munitions and clothing, and many other hastily-equipped organizations. In all of these, gas for lighting, and especially for cooking and heating, has been in urgent demand. The promptitude with which these calls have been met by Mr. Goodenough and the Company's staff has brought many expressions of appreciation. In this connection, I may mention that we have built on our premises in Goswell Road a demonstration room for the purposes of showing in work a number of examples of gas-furnaces, crucibles, ovens, and other appliances for use in various trade processes. We are taking other steps to develop the use of gas as a fuel by manufacturers.

ITEMS IN THE ACCOUNTS.

The loss to the Company due to the diminished output, which amounted to 4¾ per cent., was £77,600. The rise in price of 2d. per 1000 cubic feet for the Christmas quarter brought in £61,500—leaving a net decrease of £16,100. Much more serious in its influence upon our balance was the reduced revenue from residual products. This was no less than £193,445. Of this, £114,000 was caused by reduced prices; £75,500 resulted from the diminished quantity of coal carbonized; and the remainder—not quite £4000—was due to slightly less favourable results per ton of coal carbonized. All the main residuals—coke, breeze, tar, and ammonia—yielded lower prices. Difficulties of transport, and consequent heavy freights, are also largely responsible for this loss. As an illustration: Pitch rates to the South of France, usually about 8s. 6d. per ton, are now 30s. Again, the entrance of Germany into the sulphate of ammonia market, as an exporter, and the fear as to the effect which the synthetic production of ammonia would have on prices, were causes responsible for the fall in the market value of this product before the outbreak of war. This state of things is essentially transitory, and is already gradually righting itself. For example, the price of sulphate, which was £10 7s. 6d. at the end of October, has risen to £13 at the present time. The very high price of coal for domestic purposes has naturally reacted on that of coke, the market value of which has risen materially, while stocks, which had increased to an embarrassing degree, are now practically cleared out.

MANUFACTURING EXPERIENCES.

Reverting to our manufacturing experiences, the quantity of coal used was less by 132,500 tons, representing in money £123,000. Of the decrease in quantity carbonized, 7500 tons was due to the improved make of gas. The reduction in quantity resulted not only from the decreased output of gas, but also from the extreme difficulty of obtaining supplies of coal after the outbreak of war, and the consequent necessity of substituting oil. There has been so far no shortage of coal at the pits in Durham. The difficulty has arisen in bringing it to London. Immediately upon the declaration of war the provision of a large fleet of steamships became a necessity to the Government, and some two thousand of various sizes—very many of them colliers—were accordingly taken over. The number left was quite inadequate to the task of feeding London with coal. Stocks in hand fell rapidly; and as a matter of course the freightage charges became exceedingly high. A representation of the grave national danger attending the failure of the gas supply, as also that of other public services, was made to Lord Fisher, who gave the matter his immediate attention. The result was that a number of enemy ships interned in our ports were made available for these services, and are now running. They are not nearly sufficient to remove the danger; but they have minimized it.

INCREASED FREIGHTAGE CHARGES.

There is, however, one aspect of the transaction to which I feel it my duty to call attention. The dearth of ships, and the consequent peril I have mentioned, were the direct result of the action of the Admiralty—action which not one of us would for a moment presume to criticize. The Government, when commandeering the colliers, undertook to pay for them a rate of freight equal to about 4s. per ton carried, which was equivalent to about 30 per cent. rise upon the rate current before the war. Immediately, however, upon its becoming evident that the free steamers (those left by the Government) were unequal to conveying what was required, the freight from the Tyne to the Thames was no longer 3s., but jumped to 13s. per ton. It was, I think, natural to expect that the authorities would welcome an opportunity of lightening this burden on the community by charging approximately the costs of running the new-found ships, *plus* a reasonable margin, and not seek to make a profit out of the situation which they had rightfully (but surely with regret) created. This was not the view adopted. The present famine prices are regarded as the market rates, and are demanded of us. Our ships, which were paid for at a price of 4s., when lent back again to us are valued at three times that rate. There is a strange perversity about this action. The benefit of the higher prices—apart from the surplus profit to the Government—goes to a limited number of shipowners and shareholders in shipping companies, whose profits must be enormous, and out of all relation to the cost of the services rendered; while the sufferers who pay this Government-supported imposition are the whole community, already bearing (and bearing cheerfully) taxes of almost unexampled weight. The arrears of coal due to this Company, added to the quantity yet remaining to be delivered under the year's contracts to June 30, amount to a million tons. Upon this quantity 1s. per ton means £50,000, and, necessarily, 10s. would mean £500,000. A considerable proportion of our needs are provided for at much less than the higher figure; but if a change does not come over the policy of those in authority, this question of freight will prove a grievous one for London.

THE SHIPMENT OF COAL.

The first need of the time to us is to secure sufficient coal, and the next to get it at as reasonable a cost as may be under the circumstances. We are fortunate in having our own ship, the "Fulgens," running for us; and we have within the past week purchased two others. We have also chartered a new ship for a year (she has now made her first voyage); and, further, we have ordered the building of another ship. I may say that at the Board meeting just held we have decided to buy a third ship. It was a grave misfortune that the steamship "Vauxhall," which had been for 36 years carrying coal up the river to our Nine Elms station, recently fouled a wreck off the Norfolk coast and sank, carrying her cargo with her. Singularly, on the evening of the following day the steamship "Empress," on her return to the North after discharging a cargo at Beckton, ran into the same wreck, and was also lost. Fortunately, in each case the crew was saved.

NEW PRODUCTS MANUFACTURED.

It is a comfort that we can distil some soul of goodness out of the things evil in our industrial affairs. I am glad to say that by some modifications of our plant, we have been able to render service of importance to the Government. We are adding to the number of products manufactured—partly in replacement of articles hitherto supplied from what are now enemy countries. This will probably result in important business.

OIL USED AND ITS PRICE.

I have referred to the substitution of oil for coal in manufacture. The oil used in the half year was purchased at the high price of 2·91d. per gallon, as against 1·68d. in the corresponding half year. The larger quantity used cost us £20,590, and the increased price £33,880. The oil now in use has been bought at lower rates. Notwithstanding that oil was dear, we were able to manufacture carburetted water gas cheaper than coal gas. The low value of coke, and the reduced wages by reason of the smaller number of men employed conduced to this result. Of course, the high price of coal (with the freight added) was the main feature.

THE ACCOUNTS.

Turning to the accounts, it will be seen that the balance of working capital is improved by £26,028 on the half year. Extensions of works and plant have cost £82,293; while allowances for depreciation, *plus* £43,000 received for surplus land sold, amount to £108,321. I have dealt adequately, I think, with the important items in the revenue statement; but if further information is wanted I will gladly furnish it. The outstanding features are the reduction in the output of gas, due to military precautions, and the very severe slump in the value of residual products. This loss has converted a gain on the gross cost of coal and oil of £66,500 into a loss, upon the net, of £127,000. Rates and taxes show an increase of £8465. This is due to an advance in the rate in the pound from 8s. 3¾d, to 8s. 6d., and to the greater charge for income-tax. This is the quinquennial year, when London rates are revised. We shall, I need hardly say, use every effort to obtain some relief from this ever-increasing burden.

THE MEN AT THE FRONT.

At our meeting in August last the shareholders signified their approval of the Directors' proposal to make some allowance to married men and others who, going to serve their country, leave dependants behind.

This we have done, and hence the item of £7124 under the head of "Allowances to Employees on Active Service." The number of our employees who have enlisted is now 1700. Letters in great number have been received from camps at home and from abroad, saying how great a relief from anxiety these allowances are, both to the men and to their wives and families. The Directors and employees have formed an additional fund—called the "War Distress Fund"—to be applied for the benefit of the widows and dependants of those who unfortunately lose their lives in the war, and also, if necessary, to relieve any disabled and unable, therefore, to earn a living.

BROAD RESULT OF THE WORKING.

The broad result of our working is that we have to draw upon our reserves, in order to pay the dividend recommended, to the extent of £150,776, as against £96,000 at this time last year. These figures, without words of mine, justify the increase in the price of gas—it is hoped as a temporary measure to meet an unexampled and distinctly complex emergency not likely to prove of long duration. After what I have said upon the situation as to freights and the consequent price of coal, it will be seen that any anticipations as to the future are more than usually difficult I think, however, that I have good ground for my anticipation that the balance for the coming half year will show a considerable improvement upon that under consideration. The output of gas will doubtless be less, for the reasons which are now operating, and will continue to operate; and I cannot hope that the reduction in cost of coal will be equal to the heavier charge for freight. On the other hand, oil will show a saving; residual products (except, perhaps, tar) will command better prices; and the increased charge for gas, as compared with the corresponding half year, should add more than £100,000 to the revenue. The financial position of the Company is a strong one. The balance of unappropriated profit, after the payment of the dividend, is £384,000; and we have in various funds a rather larger amount available for use when needed. Each of our separate funds has grown considerably in recent years; while the amount of capital invested has been reduced. On the 5th of April next, £148,000 of Exchequer Bonds will be redeemed; and this amount will be available as cash for use in the Company's business.

BILLS IN PARLIAMENT.

Two Bills have been printed for presentation to Parliament this session, dealing with the electric supply of London. One is promoted by the London County Council, the other by the United Electric Light Companies of London; and each contains provisions which it will be the duty of this Company to oppose. The two Bills are antagonistic and may prove mutually destructive. I may remind you that the Company's Act of 1914 received the Royal Assent directly after our last meeting; and since the opening of the current year the testing of our gas for illuminating power has been discontinued, and is replaced by the more reliable calorific power test, which corresponds better with the uses to which town gas is applied.

THE WAR.

I now propose to you the adoption of the accounts and report, except only the clause dealing with the dividend. I do so with confidence in our future. The conclusion of the great and hateful, but necessary, war cannot, in my humble opinion, be long delayed; and it should be followed speedily by normal—possibly better—conditions. If it is prolonged, we will continue to strain every nerve to maintain the credit of the Company and to minimize the inconvenience to the community. Should some further sacrifices have to be made, we will all, I doubt not, submit to them cheerfully, in order that the great struggle may be fought out, and an enduring peace secured. To this end we should all address our individual and our collective labour and influence. There is nothing in the situation to shake our confidence in gas and in the Company. I say—not as a matter of peroration, but in sober truth capable of proof by facts and figures—that while our difficulties and disappointments are temporary and accidental, our financial and commercial strength and stability are permanent, and have been husbanded, developed, and extended for years past, so that we are thoroughly well found and equipped for weathering the storm that assails us from so many different quarters at once. [Applause.] I have now pleasure in moving:

> "That this meeting do agree with, and confirm the report of the Directors and the Auditors' report and statement of the accounts of the Company as transmitted to the proprietors on the 28th ult."

Before putting the resolution to the meeting, I shall be happy to hear any remarks which proprietors may wish to make, and will endeavour to answer any questions they may ask.

The Deputy-Governor (Mr. John Miles): I have much pleasure in seconding the motion.

Remarks by Shareholders.

Mr. A. M. Paddon was perfectly certain the sympathy of the proprietors would go out in the most generous manner to the Directors for their able administration of the Company's affairs, having regard to the difficulties and anxieties of the past six months. He felt sure there was neither the desire nor the justification for criticism. He might say, on the facts, that he did not think any surprise could be attached to the increase in the price of gas; but he did think very considerable surprise of a legitimate kind did attach to the reduction in price to the low point at which it stood before the increase was made. A cursory examination of the figures disclosed the fact that the capital account of the Company was very abnormally high. He spoke subject to correction, as it was not always possible for one standing outside to be conversant with the Company's affairs as to a point or two. But he rather thought the capital account, making proper allowances, amounted to something like £570 per million feet of gas sold per annum. He ventured to think that those who had laboured long in the field of gas administration would realize that it was not practicable, except under most favourable circumstances, to sell gas at 2s. 6d. per 1000 cubic feet with a capital amounting to £570 per million; and it was less practicable in connection with a Company who dated their tradition back a hundred years. This meant a certain amount of dead wood; and the capital did not stand in the same relation as a company whose plant and implements were new. The increase in price was, however, an accomplished fact. Whether or not it would be increased further they must "wait and see;" but he wished they could share in the cheering optimism of the remarks by the Governor to which they had listened. He would suggest, before the price of gas was again reduced to a low figure, that something should be done to reduce the capital per million. As he understood the affairs of the Company, there was an apportionment each half year to capital redemption, which was taken from the undivided profits of the proprietors. Parliament had already definitely sanctioned the principle that where a company had abandoned works and had unremunerative capital, the capital could be reduced by payment from the revenue account; and he would suggest that, before the price of gas was again reduced to a low level, the sanction of Parliament should be sought so that a certain amount might be taken from the revenue account in prosperous years. The money so appropriated should be devoted to the redemption of capital; so that the capital might be brought into consonance with the price at which it ought to sell in comparison with its neighbours.

Mr. W. A. Hounsom, referring to the remarks of the last speaker, said there was no doubt criticism on the part of shareholders was useful, as it gave the Governor an opportunity of reply. The first remark he desired to make was one of congratulation that the Governor was well enough to be present and deliver his speech, instead of it being read by another person. This was the two-hundred-and-sixth half-yearly meeting of the pioneer gas company, whose early years were surrounded by war conditions, when a great many of their most valued institutions were inaugurated with great success; and he felt sure their sympathy would go out to those of their employees who were now at the war. In looking back, what did they find? That during the past six months there had been an increase of 9500 in the number of consumers, and of 30,427 in the number of gas-stoves sold and let on hire; and there had only been an addition of 2d. made in the price of gas. This, of course, meant a reduced dividend; but still it was an extremely handsome dividend. This was really a magnificent record on the part of the Board; and it was because of the principles which Mr. Paddon had advocated that they were in this position to-day. It was the careful work in years gone by that had brought them to this favourable position; and they rejoiced thereat, and he rejoiced still more that this great Company, which had been a magnificent undertaking in years gone by, had now developed into a human entity. Of their men, 1700 had gone to the front; and the system of co-partnership was flourishing. He was sure the policy of the Directors in past years had been the right one. Of course, there would be anxiety as to the future; and they would have to stand shoulder to shoulder and face greater difficulties than they were now facing. They could not go through a war such as the present without meeting difficulties; so there must be solidarity and the greatest support given by the shareholders to the Directors. If this were done, they would go forward happily; and he was perfectly certain, having regard to the comparatively small attendance at the meeting, that it was a tribute to the Board of thankfulness for the present and calm confidence that everything would be done on the new lines which had characterized the development of the Company during the years that the Governor had presided.

The Governor's Reply.

The Governor: I shall commence by thanking Mr. Paddon for the sympathetic and helpful words that he has addressed to us; and I may say I am in sympathy with what he has said as to the wise policy for the Company. I recommend to Mr. Paddon's consideration the accounts of the Company for the past 10 or 12 years, and from that consideration he will find the policy he has advocated has been the policy of the Board in the past. He calls attention to the high amount of our capital in relation to the business done, and considers the sum of £570 per million is a high charge. I should like to see it lower. I turn to eleven years ago, and then, with a price higher than it is to-day, the capital was £675. To have brought down the capital from £675 per million to £566 is a record for which I feel I have no reason to blush. With regard to the price of gas, I do not agree with Mr. Paddon. We were in 1907 charging 2s. 11d. per 1000 cubic feet for our gas; and in that year we had a margin close on 1·6d. Upon the strength of this margin and the prospects of the future we reduced the price 1d. per 1000 cubic feet. In the following year we again reduced it, and again had, after the reduction, a balance of nearly 1d. left. Again, in 1909, we reduced the price, and again we had a balance to the good. In 1910 it was further reduced, and we had a balance left of 1·89d. In 1911 it was reduced again; and in 1912 the last reduction was made. We had increased our balance of 5·6 to 9·64. Though we had a balance of three-quarters of a million in hand, after having paid our dividend, we concluded that we would be extremely careful; and we made no further reduction. It was fortunate we did not, as from the end of 1912 we began to eat into our accumulations; and now we are drawing upon them very heavily. I am sure Mr. Paddon, after consideration of the reports, will arrive at the conclusion that the Directors could hardly have done less for consumers and shareholders than they have done. We were very pleased to reduce the price. The Accountant will give me in a moment a statement showing how from 1912 the cost of coal went up steadily half year by half year—from 2·33 in 1912 to 7·68 in December, 1914—being an increase of 5·35 to the net cost of materials. Had it not been for this, our price would have been still lower than it was at the opening of the war. So soon as the balance in hand is sufficient to enable us to reduce the price of gas, it will be reduced. [Hear, hear.] So long as we are able to keep our capital account from growing while the business increases we may look with confidence to cheaper gas. Now let me say, as I have said in the past, how much the Board appreciate the observations addressed to us by Mr. Hounsom. There is always a broad-minded view of things on his part which is cheerful and helpful; and I am sure if further sacrifices have to be made, he would recognize they are only made because they are absolutely necessary.

The motion was then put and carried unanimously.

The Dividend.

The Secretary next read the following minute as to the dividend :

Resolved : That it be recommended to the half-yearly ordinary general meeting of proprietors to be held on the 5th prox.

(1) That the sum of £10,000 be set aside out of the divisible profits of the Company for the half year ending on the 31st day of December last towards the redemption fund, in accordance with the provisions of the Company's Act of 1903.

(2) That a dividend as follows for such half year be declared :

On the 4 per cent. consolidated preference stock at the rate of £4 per cent. per annum.

On the 3½ per cent. maximum stock at the rate of £3 10s. per cent. per annum.

On the ordinary stock at the rate of £4 13s. 4d. per cent. per annum, subject to deduction of income-tax.

The Governor : You have heard the resolution read, I beg to propose it.

The Deputy-Governor seconded the motion, which was put and carried unanimously.

Re-Election of Directors and Auditors.

The Deputy-Governor : Ladies and Gentlemen, it is my pleasing duty to propose the re-election of our Governor. It is usual to name the Director for re-election and to take the vote ; but on this occasion it gives me an opportunity from this side of the table to say how much the Company are indebted to the hard work, energy, and intelligence of our Governor. [Hear, hear.] In these troublous times it is no easy task to direct the affairs of a company such as this ; and I assure you that every day your interests are constantly in his thoughts. You could not have a better Governor, look where you could to find him ; and I have great pleasure in proposing his re-election.

Sir Hugh Owen, G.C.B., seconded the motion, and expressed his entire concurrence in the remarks of the proposer as to the valuable services the Governor had rendered to the Company.

The motion was carried unanimously.

The Governor : I thank you very cordially for this vote. Mr. Miles is quite right in saying the affairs of the Company are constantly in the minds of the Directors ; and in this respect I do not think I fall behind my colleagues. I have now much pleasure in proposing the re-election of Mr. James Douglas Walker, K.C. I can say of Mr. Walker it has been a great blessing for the Board to have him upon it. His knowledge is great, and his influence is always for good inside and outside the board-room.

The Deputy-Governor seconded the motion, which was put and carried.

The retiring Auditors, Messrs. J. A. Stoneham and P. H. Ashworth, were unanimously re-elected.

SPECIAL MEETING.

Sale of Surplus Lands.

The Governor : The authority of the proprietors is now to be asked for the sale of two portions of surplus land. I do not think I explained, when speaking of the receipts on capital account, that the £44,000 received for surplus land came from the London Dock Board, who purchased it as the site for a new dock in the neighbourhood of London. After the closing of the Company's small works at Silvertown in 1909, Messrs. Henry Tate and Sons became the purchasers of the greater part of the site, and recently the remainder (about 1¼ acres) has also been sold to them, subject to your approval. The other sale relates to a very small plot, about one-third of an acre in area, on the fringe of the larger site at East Ham taken over from the late West Ham Gas Company, and used as a gasholder station. The Secretary will read the terms of the resolution, which I now beg leave to move :

The Secretary then read the following resolution :

Resolved that the following lands are not now required for the purposes of the undertaking of the Company, and the same shall and may be sold—viz. :

Silvertown Land.

All that piece or parcel of land and hereditaments situate in the parish of West Ham in the County of Essex and bounded on the North by a public highway leading from Silvertown to North Woolwich, and known as Factory Road, and on the east, south, and west sides by other land and hereditaments the property of Henry Tate and Sons, Limited.

East Ham Gasholder Land.

All that piece or parcel of land in the parish of East Ham in the County of Essex situate on the north side of Stevenage Road and having a frontage thereto of 140 feet bounded on the west by a strip of land 3 feet wide, sold by the Company to Messrs. White and Lait, on the north by the London, Tilbury, and Southend Railway, and having a breadth next to such railway of 60 feet or thereabouts, and bounded on the east by other land of the Company.

The Deputy-Governor seconded the motion, which was put and carried.

Votes of Thanks.

Mr. Neville said it only remained for the shareholders to express their confidence in the Governor, who had presided, and to give him every encouragement to continue the magnificent management which the Company had enjoyed for many years. They had never had such a difficult time as the present ; and he did not believe anyone but the Governor could have made such a splendid statement as had been made that day. It would give courage and confidence to all engaged in the gas industry. He was very pleased that the Governor was restored to health and was able to be with them again, as he was looked upon as one of their most valuable assets. He was glad to hear from the Governor that the Company were entering into communication with the Government with regard to certain industries which at the present time were supplied by foreigners, and had no doubt that he was alluding to the important question of aniline dyes. He (Mr. Neville) was connected with the textile trade in the North, and he knew there was nothing so important, from an industrial point of view, as the question of getting for England the trade in these dyes. The shareholders he was sure would support any action of the Company for helping to supply the country with such an important commodity as aniline dye. He felt he was voicing the feeling of every single shareholder when he proposed that the best thanks of the meeting be given to the Governor and the Directors for their able management of the Company's affairs. The shareholders, he was sure, would support the Directors through thick and thin, through dangerous and troublous time which had to be faced, and would shrink from no sacrifice necessary to carry out the policy of the Company.

The motion was seconded in several parts of the room, and on being put to the meeting was carried amid cheers.

The Governor's Reply.

The Governor : On behalf of my colleagues and myself, I thank you very heartily for the cordial way this resolution has been received. I should have been glad if Mr. Neville had included in the vote the officers and workers of the Company. May I propose now that our best thanks be given to them ? I am pleased to say that, in spite of many temptations to leave us, our men are constant to us ; and I can say, with regard to the staff, that no men could possibly be doing better than they are doing in the service of the Company. We have lost a great number of men from the offices and staff generally ; and without any attempt to coerce, or put upon the staff greater duties than they can fairly carry, I can say we have not added a like number to the staff to those who have gone to the war. I propose that our best thanks be given to the officers and staff of workmen for their services during the half year.

The Deputy-Governor seconded the motion, which was put and carried.

Reply on Behalf of the Staff.

The General Manager (Mr. D. Milne Watson), in the name of the staff and officers, and the employees generally, returned thanks for the vote. These were, he said, very difficult times, and full of anxiety and hard work for all, right through the whole rank ; but he could assure them that the staff all shared with the Governor and the Directors in their belief that the Company would pull through to better times, and the staff would do everything to achieve this result.

The proceedings then terminated.

COMMERCIAL GAS COMPANY.

The Ordinary Meeting of the Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. W. G. Bradshaw in the chair.

The Secretary (Mr. F. J. Bradfield) read the notice convening the meeting ; and the Directors' report and the statement of accounts were taken as read—see last week's "Journal," p. 248.

The Late Deputy-Chairman and the New.

The Chairman : I beg to move—"That the report and the accounts be received, adopted, and entered on the minutes." Gentlemen, it is with the deepest regret that I have to commence my observations by referring to the great loss the Company has sustained in the death of the Deputy-Chairman (Mr. Walter Hunter), which took place on Sept. 9. Mr. Hunter became a Director of the Company in 1895, and was elected Deputy-Chairman in 1901. He was an Engineer by profession ; and although his experience had been chiefly gained as a Mechanical Engineer, and an Engineering Director of one of the large Metropolitan Water Companies, his wide professional knowledge was of great service to the Company. In all its operations he took the deepest and most painstaking interest ; and no trouble was too much if he could do anything to advance its interests. His colleagues will ever remember with appreciation his uprightness of character and his kindly and genial disposition. We very much regret his loss. In his place as a Director, we have, in accordance with our Act of Parliament, unanimously elected Mr. T. F. V. Buxton, who, as you all most probably know, is the eldest son of the head of the well-known family of that name. Many of you are aware of the long connection of the family with the East End of London—the districts we serve ; and their public and philanthropic labours over the last century are known throughout the world. Mr. Buxton comes to us not as a stranger, but as a friend. We anticipate that the Company will derive great advantages from Mr. Buxton's association with it ; and we offer him a very hearty welcome to his first shareholders' meeting. We have also unanimously elected Mr. H. E. Jones to be Deputy-Chairman. You are fully aware of his long and honourable connection with the Company, his eminence in his profession, and his great knowledge of all matters relating to gas affairs ; so that I will only say that he is in every way qualified to adorn that or any other position in a gas company. We think ourselves very fortunate in having such a Deputy-Chairman.

The Income and Coke Sales.

Now, Gentlemen, the results of the half year are precisely what we led you to expect they might be when we met you in August last. They are not so good as we had reason, at one time in the half year, to hope they would be ; but, under the special circumstances created by the war, there is no cause for dissatisfaction with them. At the same time, you will have noticed that the profit for the half year only amounts to £46,208, which is £18,946 less than it was this time last year—indeed, it is less than it has been for any half year since June, 1901. But the loss of profit is not wholly, although it is largely, due to the effects of the war. Our revenue receipts are less by £9283 on account of the lower prices at which we sold our residual products. The prices of coke, tar, and sulphate of ammonia were falling rapidly during the first six months of the year—mainly, I think, owing to the great extension which has taken place in the erection of coke-manufacturing plants all over the country, and which flooded the market with coke. During the first half of the year, as I think I explained last August, there was practically no demand for coke. All the companies ended the half year with huge stocks which they could not sell. We made very great and very special efforts to increase the sales, and met with considerable success in extending our market. Although we

have not derived from this very great advantages this half year, yet I think that in the future we shall reap considerable benefit from the fact that a great many manufacturers in our district have substituted coke for coal as their standard fuel. In order to obtain their custom, we had, of course, to sell them the coke at the low price then ruling; and when the war came, and brought about a shortage of coal, and the price of coke increased somewhat, we had already sold a great deal of our stock, and therefore did not have the advantage of the higher prices which obtained. The amount of coke sold in the half year was a record one. It exceeded 62,000 tons. We began the half year with a stock of 16,611 tons, and ended it with only 4331 tons.

THE EFFECTS OF THE WAR.

As "The Times" reminded us this morning, it is exactly six months to-day since we declared war against Germany; and the question you will naturally put to your Directors is this: How has the war affected the Company? In the first place, it has affected the Company by reducing the amount of gas sold. We sold in the past half year 64½ million cubic feet less than in the corresponding half of 1913, which is equivalent to a falling off of 3¾ per cent. on our total sales of gas, and represents in money £8037. Our neighbours suffered equally with ourselves. The Gas Light and Coke Company had a falling off in their sales of 4¾ per cent., and the South Metropolitan Gas Company of 4¼ per cent. This falling off was caused principally by the restrictions placed upon the public lighting in London; and, in consequence of these restrictions, shops closed earlier, and so used less light. Then, again, there were the shorter hours that public-houses were allowed to keep open in the Metropolis. Of course, all this led to a smaller consumption of gas. Then we thought it wise to offer additional inducements to large users of gas for trade and power purposes to keep up their consumption; and we gave them large discounts. This was done because the retention of these larger accounts enabled us to sell gas at a lower cost to our small consumers; and therefore they derive a benefit from this proceeding. Moreover, in our district there was some decline in the trade of factories not supplying war material; but this was partly compensated for by the increased trade of the factories supplying army clothing and food stuffs, all of whom have experienced a time of considerable activity. The second way in which the war has affected the Company is that it has had the result of largely increasing the cost of carriage of coal from the Tyne to the Thames. You are aware that we alone of the London Gas Companies have our own ships. In normal times these ships would be capable of transporting nearly all the coal we require in the course of the year. Therefore, because we possess our own ships, we have suffered much less in this respect than our neighbours. The Admiralty requisitioned some 2000 colliers to supply coal to the Fleet; and other ships were also taken by them for purposes connected with the transport of war material to the Army. Consequently, ships were very difficult to get; and their chartering was very expensive. Then, further, the Admiralty found it necessary to make certain regulations restricting the running of ships in the North Sea except in daylight; and they made it compulsory to have pilots in entering and leaving harbours. These regulations, of course, accentuated the difficulties caused by the shortage of ships, because the available ships were able to make fewer voyages. As a result, our ships, which in the half year ended Dec. 31, 1913, conveyed 87,375 tons of coal from the Tyne to our works, in the half year ended Dec. 31, 1914, only carried 70,760 tons—leaving a balance of 16,000 or 17,000 tons, or about one-fifth of our needs, for which we had to charter steamers as best we could. This was a difficult and expensive operation; and it had the effect of increasing the cost of the carriage of coal from the North to London from 3s. per ton to 3s. 11d. But when you bear in mind that the cost of freight has gone up from the normal 3s., or thereabouts, to no less than 13s. 6d. per ton, you will see what an enormous advantage we have gained by having our own ships. In spite of this, however, the extra cost to us in the half year has been £4361, which reduced the saving we expected to get from the lower prices of coal and oil from between £5000 and £6000 to about £1100. I may say here that a rumour reached me last night that some of the consumers in the poorer parts of our district are apprehensive lest the coal supply should cease altogether, and we should not be able to go on supplying gas for their convenience. Let me say emphatically that I do not think there is the least fear on that account. We have large stocks of coal, and the largest stocks of oil we have ever had in the history of the Company; and I have not the slightest doubt that we shall be able to continue without interruption our duty to the consumers. We are also suffering some loss owing to the war, in that we have to pay our seamen and firemen very much higher wages. To a certain extent these are fairly earned, because of the disturbed state of the North Sea and the greater difficulty and danger of navigation; so that, although these higher wages are costing the Company a considerable sum, we cannot really grudge it. You will also have seen from the public Press that the Government have authorized the use of a certain number of German ships interned at the beginning of the war; but, instead of their offering these ships to the gas companies and other institutions with public duties to perform, they have made the mistake of practically putting them up to the highest bidder. Although I understand the freight asked has come down from 13s. 6d. to 11s. per ton, still this represents something like 5d. or 6d. on the price of gas to companies who are dependent on these steamers, and so is a very heavy tax upon them. Unless some more effective steps are taken to provide ships to replace those requisitioned by the Government at the commencement of the war, I fear that in some parts of London the gas supply may be jeopardized. This would bring hardship and loss on poor people; and it may be that some of the public streets will be inadequately lighted. It is proposed to lay these facts before the Prime Minister as soon as possible, in order that the Government may know the position, and may take prompt and remedial measures to meet the situation. Another effect the war has had upon the Company's operations is that the price of the materials we use in our business has, in nearly all cases risen very much. I may instance glassware, which has advanced in price by no less than 50 per cent., and mantles, the cost of which has risen by 25 per cent. All this tends to reduce profits. Yet another charge upon the revenues of the Company due to the war is the payment of a proportion of the salaries and wages to those of the staff and employees who volunteered to serve in His Majesty's forces. We do not grudge this. All honour to those who have responded so promptly and willingly to their country's call. Honour is also due to members of our staff and workmen who, by reason of age or duty, have been prevented from responding in the same way, for they are cheerfully and willingly shouldering the extra responsibility and work which the absence of the other members of the staff has thrown upon them. I cannot say enough for what they have done this half year. I am glad to tell you that no less than 700 or 800 of our staff voluntarily enrolled themselves as special constables under the leadership of our Engineer (Mr. Stanley H. Jones), and have undertaken the important duty of safeguarding the Company's works. This has involved patrol duty during the dark, cold, and wet winter nights, which have brought upon the men considerable hardship, which they have borne with alacrity and cheerfulness. For this they have received no extra pay; but we are bound to thank them for volunteering their services.

REDUCED PROFIT AND THE BENEFIT OF UNDIVIDED BALANCE.

The net result of these conditions on our revenue account is that the profit is less by £18,946 than it was this time last year, when we paid our full statutory dividends, and had a balance of only £652 to add to the sum carried forward to the next half year. In other words, our earnings on this occasion are short of our statutory dividend by £18,294. But, gentlemen, we have a large sum of undivided profit amounting to no less than £79,569 upon which to draw. As I have frequently explained—and I think you will agree with me—the only justification for carrying forward such a large sum is to use it for keeping down the price of gas in bad times. It is interesting to look back, and see how the undivided profits have in past years stood between us and fluctuations in the rate of dividend and the price of gas. Looking back through a tabular book that I keep, I find that in 1889 we had a sum of £66,000 of undivided profit to carry forward. In 1892 this had all disappeared; and we took nearly £6000 from the reserve fund in order to pay the dividend. Then we resumed building it up until, in 1894, it had got to £24,000. We had again to draw upon it until in 1898 it had once more disappeared; and £2000 had to be taken from the reserve fund. Then we built it up again; and in 1900 it had once more disappeared. We recommenced replenishing it; and by 1904 it had reached £24,000. It went down in 1905 to £16,000; but by 1908, it was £25,000. It fell once more the following year; but since then we have gradually strengthened it, until at the beginning of 1914 it was £93,518. We have since drawn it down to £79,569; and we shall now have to take £18,294 from it, which will leave us £61,275 to carry forward. These figures will show you the value of having what might be termed a "shock-absorber" between your dividend and the necessity of having to raise the price of gas. I trust that the £61,275 will stave off the evil day; but in such times as now I dare not be a prophet.

INCREASING CONNECTIONS.

When one is talking about reduced profits, one is pleased to be able to give a satisfactory report as to the prospects of the Company. The number of the consumers goes on increasing—slowly it is true, but surely. The number of our ordinary consumers exhibits an increase of 235 over last year; the coin meters, of 1712; and we have 1939 more stoves on the district. This, as I say, is slow progress, but it is progress that is sure.

GAS UNDERTAKINGS AND THE ANILINE DYE SUPPLY.

One effect of the war has been the cessation of the supply to this country of aniline dyes. You will remember that the process of manufacturing these dyes from coal tar was discovered by an Englishman—the late Dr. Perkin. For one reason or another, England never took up the practical exploitation of this discovery; and practically the whole of the trade fell into the hands of Germany. In fact, I believe when the war broke out there was only one considerable factory outside Germany, and that was in Switzerland. But aniline dyes are used in many processes in England; and the Government, as you will have observed from the newspapers, have come to the assistance of the industries using them, and have helped to form a public company to take up the manufacture of the dyes. But I cannot help thinking that the most suitable people to manufacture aniline dyes are those who produce coal tar, which is the raw material from which they are made. We would gladly take up the manufacture if, in some way or another, we could be assisted, or protected for some years after the war ceased from ruinous competition from Germany. The most earnest Free Trader could not fail to recognize the patriotic benefit of some such protection.

THE LONDON ELECTRICITY SCHEMES.

The London County Council have been promoting a Bill in Parliament, which would enable them to purchase the electricity supply undertakings of the companies and municipalities in and around London. This up to a point is all right enough; but there were provisions in the Bill by which, when the new electricity authority became the producers, they would have the power to subsidize the concern by the aid of public funds. The Bill, in effect, provided that, if they sold electricity at non-paying prices, any deficiency thereby caused might be made up out of the rates. To this manifestly monstrous, and unfair provision, we and other people had combined to offer the most strenuous resistance. I see from the papers that the Bill failed to obtain the statutory majority at the meeting of the County Council on Tuesday. But I am not quite sure that it is dead. At any rate, we are going on with our opposition until we are quite sure the Bill is not only dead but buried. There is also a similar Bill promoted by the London Electric Lighting Companies, which we shall also resist to the utmost of our power.

NO FORECAST AS TO THE FUTURE.

I am not going to attempt to forecast the future. But I may say this, that your Company is in a strong and sound position; and if we, as I have no doubt we shall, manage to surmount the difficulties of our coal supply, I hope in six months' time we shall have satisfactory re-

sults to place before you, and we all sincerely trust we shall then meet in a time of peace. [Applause.]

The DEPUTY-CHAIRMAN (Mr. H. E. Jones) seconded the motion.

Mr. GEORGE ENNIS said that, as an old shareholder, he should like to be allowed, on behalf of the proprietors generally, to express their deep regret at the loss of Mr. Walter Hunter, and to desire that the Board convey to the widow and family of their late Deputy-Chairman an expression of the proprietors' condolence and regret in their bereavement. He had scanned the report; and he considered that it was an excellent one under the circumstances, as well as was the administrative disposition of the vacant seat at the Board. It was with very great pleasure that he learned of the elevation of Mr. H. E. Jones to the vice-chair. Mr. Jones was well known in his profession; he was Chairman of a large Metropolitan Company which was growing very extensively, and at the same time he must take a very prominent part in the work of the Commercial Gas Company's Board. The Chairman had given such a clear *résumé* of the results of the half-year's operations, and the effect of them, that it was not necessary to say much upon the report and the accounts. The main fact for the proprietors was that, while other companies had of necessity had to reduce their dividends, their own Board, through their conservative policy over so many years, were enabled, in spite of the working not having earned sufficient profit for the half year, to pay the same dividend as before. This was a very agreeable and noticeable event. He was glad to be in a position to say this, because the loss of dividend to a great many people was a matter of considerable importance. It was also a pleasure to hear that the Company's men were so willing, staunch, and loyal in every possible way, and to know that the Company were treating so well those who had volunteered in the country's service and their dependants. The proprietors need not begrudge the money spent in this way. Of the men who were left behind, the proprietors were gratified to hear such good report as to the way they were doing service in other respects. He complimented the Board sincerely upon the report; it showed very good work on their part, and on that of the staff and workmen.

Mr. R. JOLLIFFE also thanked the Board and staff for the excellent report and accounts. He had, previous to receiving a copy of the former, rather anticipated that he would not get a dividend at all on this occasion, or at any rate that it would be a reduced one.

The CHAIRMAN thanked Mr. Ennis and Mr. Jolliffe for their kind words.

The motion was unanimously carried.

OTHER RESOLUTIONS.

Proposed by the CHAIRMAN, and seconded by the DEPUTY-CHAIRMAN, a dividend was declared at the rate of £5 9s. 4d. per cent. per annum upon the 4 per cent. stock, and of £5 6s. 8d. per cent. on the 3½ per cent. stock, both less income-tax.

The CHAIRMAN moved the re-election of the retiring Directors (Sir Frederick Green and Mr. H. E. Jones), remarking that "good wine needs no bush."

Mr. H. D. ELLIS, in seconding the motion, said, in regard to Mr. Jones, who appeared before the proprietors for the first time as Deputy-Chairman, it was more than 35 years since Mr. Jones and himself became colleagues in the Company's service. They had together seen the Company grow until it had reached the pitch of prosperity the Chairman had so eloquently portrayed that day. He (Mr. Ellis) had learned the value and the eminent advantage of the counsel of Mr. Jones, as well as of his guidance and management of the Company, to which guidance and management they owed, in large measure, their prosperity. Sir Frederick Green was known to all the proprietors so well that he need not say one word in regard to him.

MR. JONES GLANCES BACK.

The DEPUTY-CHAIRMAN, replying in the enforced absence of Sir Frederick Green, both on that gentleman's behalf and his own, first expressed their sense of obligation to the proprietors for their renewed confidence. The Chairman had alluded to an act of promotion which had lately been exercised towards himself in putting him into the deputy-chair. This could only have taken place, he could assure the proprietors, by the abnegation of Sir Frederick Green, who was considerably his senior at the Board. As the proprietors would appreciate, it was some concession on Sir Frederick's part to permit him (Mr. Jones) to take this place, because they were, perhaps, not all of them aware that in steam and ocean navigation Sir Frederick—who was a Director of the Great Eastern Railway and of the Suez Canal, who was also connected with land developments in Australia, and so crossed many seas—had a great European reputation and distinction. Therefore, to occupy a position that he (Sir Frederick) might have had was the greater compliment to himself. His pride was that he should be allowed to continue to assist in the counsels of the Commercial Gas Company, of which he was very proud indeed. So many years of his life were spent in its service that he long ago became very attached to it. The progress of the Company had been traced by the Chairman in graceful, convincing words; and he had given illustration from his note-book of how the accumulations of the undivided balance had shown considerable fluctuations. The Chairman would remember that on one occasion when there was a great threat of electrical competition, they—Mr. Bradshaw being then the Chairman, while he (Mr. Jones) was Engineer only—had great difficulty indeed in persuading the Directors to allow the reserve fund to be depleted rather than raise the price of gas. But they did succeed; and the effect of this was to secure the Company's business against the new competition in a way in which there was no similar example, at any rate anywhere round London. The most eminent gas authority as he thought at the present moment—Mr. Charles Carpenter, D.Sc., the Chairman of the South Metropolitan Gas Company—pointed out a little while ago how the circumstances of the Commercial Gas Company had been varied by the direction so as to adapt it to the opportunities presenting themselves in a district which was circumscribed, hide-bound, contained no residential properties of any importance, no amusements, no clubs—[laughter]—at any rate, not to compare with those that existed in the centre or the west of London. But out of the great mass of industrial population, out of the great works employing the population, the methods of the Company had been such as to adapt their business to their opportunities. As the Chairman had properly told the proprietors, there was no Company—and he (Mr. Jones) knew a good many—which stood in firmer position to-day than the Commercial Company. The Chairman had touched on the question of dyes. He could tell them of something else which was produced from coal tar—that was the most effective explosive that was used by the German forces against England was a product of gas tar. It was trinitrate of toluol; and their own Government were doing all they could to manufacture this explosive of the greatest efficiency. He should like to add that there was one regret in connection with the fresh step given to him on the Board. It was that the position was vacated by the friend of his boyhood's years. They had been friends for something like sixty years; and Mr. Hunter had always exercised towards him, throughout his long life, the most generous kindness and indulgence.

The CHAIRMAN remarked that the next business was the re-election of the retiring Auditor (Mr. Bertram W. Ellis), who was absent on military duty. Therefore they could excuse him, and wish him every success.

Moved by Mr. JOLLIFFE, and seconded by Mr. CREER, Mr. Ellis was duly re-appointed one of the Auditors.

VOTES OF THANKS.

Mr. H. W. GELL, in proposing a vote of thanks to the staff and workmen, said they were all military in these days; and naturally military metaphor rose to one's mind. The staff were to them what they might call the "sinews of war." However much they did on the Board in devising or conceiving policies and projects and plans, it would all be quite useless if they had not the muscles and sinews to carry them out and to realize them, and make them actualities. It was the staff and men who did this for them half year by half year. There had never been a time when more than in the last six months they had been beholden to the staff and men, or owed them a greater debt of gratitude from the highest to the lowest.

The CHAIRMAN seconded the motion, and bore his testimony to the excellence of the work done for the Company by all from Mr. Stanley Jones and Mr. Bradfield downwards.

The motion was heartily carried.

Mr. STANLEY H. JONES, on behalf of the engineering staff, thanked the mover and seconder for the kind things they had said and the proprietors for their vote. He was particularly glad to hear the reference to the workmen, because although the members of the staff had to direct, the men had to carry out. At the present time, there was a good deal demanded of the men. He could speak from personal knowledge to the fact that they were most ready and willing to do anything to help, and in particular to perform the special constabulary duty. The Chairman had referred to the duty as an arduous one. But he (Mr. Jones) was proud to say that the system they had adopted for protecting their works had met with the highest praise from the authorities; and he believed the scheme had been adopted as a model. As to the business, he looked hopefully to the future, having every confidence that they would carry through this half year certainly as well as, and he hoped better than, the past one. The results of the coke campaign (in which the Assistant Engineer had especially made a name for himself) was, he believed, going to bear rich fruit.

Mr. BRADFIELD also replied on behalf of the clerical staff. The past half year, as the Chairman had said, had been a strain on the staff. A large number of its members had enlisted; and consequently the increased work that this entailed had made great demands upon those left behind. As to the profit-sharing system, it was as well established and strong as ever; but in regard to the Sick Benefit Societies, he was sorry to say there had been a large increase in sickness during the past half year. He hoped, however, that with the better weather they were now expecting, the sickness would be reduced.

Mr. WILLIAM GROVES, J.P., proposed a vote of thanks to the Chairman and Directors. He thought the balance-sheet spoke for itself, and showed the wonderful skill that had been manifested in the management of the business to produce such excellent results under such circumstances. He was pleased to be able from personal knowledge to confirm all that had been said with regard to the Company's men enrolled as special constables. The staff and the men had shown great willingness in carrying out this important piece of public work.

Mr. M'NAUGHT seconded the motion; and it was cordially passed.

The CHAIRMAN, replying for himself and his colleagues, said it was a pleasure to them to serve the proprietors in any way they could, and to see the Company prosper in spite of the present somewhat stormy circumstances.

TOTTENHAM LIGHT, HEAT, AND POWER COMPANY.

The Half-Yearly Ordinary General Meeting of the Company was held last Saturday, at the offices, No. 639, High Road, Tottenham—Sir CORBET WOODALL, D.Sc., in the chair.

The SECRETARY (Mr. E. Topley) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

GAS CONSUMPTION DURING THE WAR PERIOD.

The CHAIRMAN, in moving the adoption of the report and accounts, said, contemplating the darkened roads and gloomy shops, the man in the street might be excused if he concluded that the business of the gas maker was moribund, if not dead. While, however, the lights were dimmed, and growth interrupted, the general position of the Company was not one to cause serious concern. Looking for a minute at the affairs of the past year, it would be seen how the war, which overshadowed all, cut across it as a dividing-line. For the first seven months, progress was about as in 1913—less than in the very fat years, but still fairly good. The increased sale of 5·69 per cent. recorded at Midsummer, 1914, over that of the combined Companies—Tottenham and Enfield—in 1913 was not unsatisfactory; and it was typical

of all departments of the Company's business. From August it was a different story, as was shown by the average consumption. For the first six months, there was an increase in the gas consumed per ordinary meter of 0·36 per cent., and per prepayment meter of 4·52 per cent. For the second half, this was altered to: Ordinary meter *minus* 5·92 per cent.; prepayment meter *plus* 0·76 per cent. The extinguishing of tradesmen's outside lamps during the Christmas quarter alone caused an estimated loss of 2·9 per cent. of the whole rental for ordinary meters. In the half year, the increase, instead of reaching from 5 to 10 per cent. as in the past, had fallen to 0·25 per cent. Personally, he was relieved to know that the difference, small as it was, was on the right side.

COAL, FREIGHTS, AND OIL.

During the six months, grave difficulty had been experienced in obtaining coal in sufficient quantity for the Company's needs. The cause had been the withdrawal of a very large number of colliers from the coasting trade, to form part of a great fleet of steamers needed by the Admiralty to convey supplies for His Majesty's ships, to carry troops and stores to the army on the Continent, and—alas that it should be so!—to bring home sick and wounded soldiers. When the contracts for the purchase of coal were made in the spring of the year, the rate of freight from the Durham coalfields was about 3s. per ton. Because of the dearth of ships, this freight went up from 3s. to 13s. per ton, a portion of which difference the Company had borne, and would yet have to bear. It was for this reason that the price paid for coal at the works did not show the full saving effected when the coal was bought in June. It was fortunate for the Company that they were able to supplement the coal gas made by a considerable quantity of carburetted water gas. The quantity of coal used was thereby reduced by about 7000 tons, while the quantity of oil rose from ¾ million gallons to over 1 million gallons. Fortunately this considerable alteration of relative proportions involved no loss; the cost of the oil gas being slightly less than that of the gas made from coal. It was because of the large proportion of oil gas made that they were able to show a considerable saving in manufacturing wages; the number of men needed being much less.

THE CAUSE OF REDUCED PROFITS.

Looking at the revenue side of the account, the real cause of the reduced profits was seen. The income from gas was less by £5800, although the quantity sold was slightly more than in the corresponding half year. This was explained by reductions in the price charged, which were in Tottenham 1d. per 1000 cubic feet, and in Enfield about 4d. per 1000 cubic feet. This was a loss they could hardly regret, as they knew that, by lowering the price, they laid the foundation for improved business. The serious trouble rested with residuals. Owing to over-production, coke stocks were heavy in the middle of the year. Mild weather reduced the demand, and oven coke competition was severe, and for these and other reasons coke became a drug in the market. Some recovery was now taking place; and in the current half year the Company should do better. Tar suffered also because of the war. Pitch, which was largely used for briquette making in France, could hardly be sent there, because the charge for freight was so high as to equal the total price obtainable for the delivered material. Sulphate of ammonia fell to the lowest price it had reached for some years; but the market value was now improving. In fact, the market price to-day was a very satisfactory one. Of the £9614 decreased return from residuals, about £950 was caused by the less quantity of coal used, and all the remainder was due to bad markets. The prospect for the current half year with regard to residuals was better all round. Coal must continue dear; but oil at a lower price would help them. There were other promising circumstances before them. For instance, all the gas for the combined district would be made this half year at Tottenham; the more expensive manufacture at Ponder's End being discontinued. These latter works had been put into proper repair, and would be kept in reserve until the extended plant, now erecting at Tottenham, had been satisfactorily started. He might say that inasmuch as the works had been put into thorough repair, there would be no repairs to be charged to the accounts for the current half year. The costs of amalgamation were all now paid off. In the net revenue account, there appeared an item of £2509—the stamp required on the conveyance of the property of the Enfield Company to the Company, which was only settled with the Inland Revenue Authorities just before the end of the year. It represented 1 per cent. on £255,000 capital and assets taken over. There would be no reduction in the price of gas this year. This had been their yearly custom for so long that they had come to look upon it almost as a working charge. The Company had passed, the Directors hoped, the worst time. The undivided balance had prevented the need of increasing the price of gas so far; and, with improving prospects, it might enable them to go through the crisis without doing so.

THE CAPITAL ACCOUNT—THE PROJECTED NEW HOLDER.

Just a few words on the capital account. The proprietors knew how much importance was attached by the Directors to keeping this and the attendant charge for dividend and interest as low as possible. In 1905, the capital employed represented a little over £500 per million sold; while last year at this time it was down to £388. By that time, however, all the works were fully employed; and the extensions upon which they were now engaged had been decided upon. He need hardly tell the proprietors that these were the conditions under which capital was earning the highest return. The amalgamation with the Enfield Company, satisfactory as it was, made a considerable addition to the average rate of capital to output—an addition which involved the need of maintaining a differential charge for gas between the two districts. Now, further, they were launched on the heavy expenditure for new works at Tottenham, of which one important item—the tank for a large new gasholder—had been completed at a cost of nearly £16,000. The construction of the holder itself had been let to a firm of German contractors; but the outbreak of war terminated the agreement. In view of the temporarily diminished demand for gas, the Directors had decided to delay proceeding with the work—possibly for a year. In view of the extensions generally, the capital in relation to output must for a time continue to increase. The charges for dividend and interest were still small—reaching only 6·32d. per 1000 feet sold. With the return of normal conditions, any additional moneys spent would quickly become remunerative. The electric capital now stood at £22,391.

THE MEN AT THE FRONT.

Of the regular items in the revenue account, probably the most satisfactory was that of rates and taxes. This showed a reduction; the poor rate in both Tottenham and Edmonton having been reduced. Another cause for congratulation was that the number of attacks upon prepayment coin-boxes had been reduced to less than one-half as compared with last year. It was gratifying to find in this confirmation of the experience at assize courts, petty sessions, and police courts, that crime had largely diminished since the war began. As Mr. Topley remarked in his report, this was "the only good thing it is possible to chronicle as due to the war so far." The proprietors would not grudge the items in the account for payments to dependants of men on active service, and the contribution to the Prince of Wales's Fund. The Directors' were granting sufficient to make up the Government pay and allowances for married men to full pay. A minimum of 5s. weekly was made in each case; and if not required for the purpose of making up the pay, it was reserved in a fund until the end of service, when it would be paid to the man or his legal representative. The proprietors would no doubt like to hear of their men who were risking their lives for their country in France. The Company had now the proud total of 200 serving; and up to the present they were happy in having to record only the loss of one—Thomas Sutton, who went down with the "Cressy." They all hoped that their losses might remain small; but they were proud their comrades were taking their share in the great fight. It could also be recorded that, if it were not for the strictness of the medical examination, the numbers of their men serving would be much greater; and credit was due to those who had offered and had been refused, just as much as to those whose better health gave them the honour their weaker but willing brothers would like to share.

SUCCESSFUL ISSUE OF STOCK.

The £40,000 "B" stock of the Company which was offered for sale by tender on Jan. 19 had been duly allotted, and realized the satisfactory average price of £112 16s. 9d. As usual, by far the greater part of the issue was taken by the Company's shareholders and consumers.

GAS-DRIVEN ELECTRICITY WORKS FOR WOOD GREEN.

Some particulars relating to the electricity undertaking might be of interest to the proprietors; but owing to the fact that the supply had only been available for a few weeks, it was impossible to give any figures of the working. Though the first contracts for the machinery, buildings, &c., were let as long ago as January last year, so many difficulties were met with in the way of strikes, delays in obtaining iron and steel, and later on delays caused on account of the war and difficulties of transport, that it was not until Dec. 19 that current was switched-on to the mains. The district of Wood Green, which alone they had power to supply, was essentially a residential one; and it was also a considerable shopping centre. There were few factories, and there was little prospect of a day load for power and trade purposes. These circumstances rendered it very suitable for the generation of electricity by means of gas plant worked in conjunction with a storage battery; and it was believed this was the only undertaking arranged on these lines in the London area. The plant installed consisted of one 100 KW. set, and one 200 KW. set, with all the necessary appliances. The battery had a storage capacity of 840 ampere-hours at 480 volts. The supply was given on what was known as the three-wire system, so that for lighting the current was given at 240 volts, and for power purposes at 480 volts. The building in which the plant was installed was large enough for the addition of two more sets of 200 KW. capacity each. Up to the present they had 48 consumers. There had been received considerably over 100 inquiries and applications; but of these a number were in streets in which there was as yet no cable; and many who inquired about electricity in the earlier part of the year, and indicated their intention of taking a supply had not yet done so—doubtless owing to the extra expense to which everyone was being put on account of the war. The Directors had, however, laid no less than 18 miles of cable in the Wood Green district. There was every confidence that, in the course of a few months, they would have a sufficient number of consumers to make this department a profitable one.

CONFIDENCE AS TO THE FUTURE.

His story had been a somewhat diffuse one, containing an assortment of lights and shadows; but, on the whole, he meant it to be cheerful. He looked to the future with much confidence; and he proposed the adoption of the report and accounts with an easy mind as to what would be their position when they met again.

Mr. HENRY BAILEY seconded the motion, which was unanimously adopted.

THE DIVIDEND MAINTAINED.

The DEPUTY-CHAIRMAN (Sir Daniel F. Goddard, M.P.) moved the declaration of dividends at the rate of 5 per cent. per annum on the preference stock, 7½ per cent. per annum on the "A" consolidated stock, and 6 per cent. per annum on the "B" consolidated stock—all less income-tax. In doing so, he said he had never found in his experience that this resolution required much of a speech to commend it to the proprietors. It was one usually accepted by acclamation; and on this occasion, very few words were necessary. The Chairman had, in his admirable speech, alluded to the fact that the dividend had not been quite earned in the half year, thanks to the "blasting breath of grim war" which had affected the gas industry as all industries and interests of the country. This was true; but the Company had been managed with some care, and some anticipation. They had therefore a considerable balance which had been carried forward from time to time to meet stormy weather and bad times. Therefore, they could have no hesitation in drawing on this fund to make up the amount that was re-

quired for the dividend, and which was lacking in the revenue account for the past half year. He did not think anybody could cavil at this. They all rejoiced that a man of such large experience as their Chairman should be able to conclude his remarks in such a felicitous way as he had done, and to take such a cheerful view of the future. Upon this he (Sir Daniel) heartily congratulated him; and with it all he thoroughly agreed.

Mr. JAMES RANDALL seconded the motion, which was adopted.

VOTE OF THANKS—LOYALTY TO COUNTRY AND COMPANY.

Mr. H. D. ELLIS proposed that the best thanks of the proprietors be given to the Chairman and Directors, the Auditors, and the officers, staffs, and workmen of the Company, for their services during the past half year. He remarked that this was one of the most pleasant resolutions that could be moved in that room, because they could all whole-heartedly and candidly acknowledge that their thanks were eminently due to their Directors and all associated with them for the conduct of their affairs during the very trying times they had gone through. He was sorry to think these trying times were not over, and perhaps would not be for a long time yet. He had no doubt, however, the Board would do their utmost, and that utmost would tide over the difficulties as well as it could possibly be done by any human agency. The proprietors had also to thank the Auditors; and they had to welcome among them that day for the first time, as an Auditor, Mr. John Eve. As to the officers, staff, and workmen, the Company were admirably served; and the relations of all, he knew, remained most happy. In speaking of the staff and the workmen, their thoughts especially turned to those who were not at present working with them, but were working for all at home, serving the country, on a grander scale than they could possibly do in their ordinary walks of life.

Mr. HERBERT MICHEL, in seconding, said the Company had a Board in whom the proprietors had full confidence. They had the best of Chairmen; and he had colleagues who worked in complete harmony with himself. They also had admirable officers and an excellent staff. To the efficiency of the staff, their success was largely due; and the efficiency was owing to the admirable direction of the Company. Able and loyal men always surrounded themselves with able and loyal men. The fact that they were to receive, in the circumstances of the times, the same dividends as they had been receiving during times of peace, must be a source of satisfaction not only to the proprietors, but to the Board. He was pleased the Board had exercised so much discretion with reference to the dividend. Some boards of directors forgot that, in a time of stress such as the present—a time such as those present and their immediate fathers had not known—the needs of many shareholders were greater than at any other time. Constant demands were made upon them, which all patriotic men and women were anxious to meet. With increased taxation, and decreased dividends and income, these opposing conditions would make life exceedingly difficult for many people. But their own Directors, owing to the financial soundness of the Company, were fortunately able to pay the same dividends. One other matter. No terms could have been happier than those in which the Chairman had alluded to the men who were risking their lives for them and for their country. He hoped in some way their men who were absent from them would be made aware that the proprietors were thinking of them that day, and that their heartfelt wish was that they might be spared to come home and receive the thanks of a grateful country, among which would be mingled those of the proprietors of the Company. [Applause.]

The motion was heartily carried.

The CHAIRMAN, in reply, said the proprietors had not met that day to no purpose, if it had only been to hear the admirable speeches that had been made in proposing and seconding this resolution. They would certainly take steps to see that the words of Mr. Herbert Michel reached their men who were away at the front. The Board appreciated very highly all that had been said, and the manner in which the proprietors had received the motion, because the Directors felt they were in a position not only of responsibility, but also of some anxiety. The Directors had recommended the dividends with exactly the sentiments in their minds to which expression was given by Mr. Michel. They felt that, so long as it was possible to do so without, in their opinion, undue risk to the finances of the Company, it was their duty to pay the full dividend. While they were all bearing more than ordinary taxation—taxation almost unexampled in the history of the nation—each one wanted all the help he or she could get in order to meet it. He wished to endorse what had been said with regard to their officers and men generally. Although their two chief officers—Mr. A. E. Broadberry, the Engineer and General Manager, and Mr. E. Topley, their Secretary—were suffering from influenza, and were not "up to the mark," their capacity for work seemed undiminished. In regard to the men, the Company were certainly feeling the advantage of the co-partnership arrangement, by the manner in which the employees generally carried out their work. [Hear, hear.] There was distinct evidence among the men of a desire to do all they were capable of doing in order to help through this time when economies were essential in carrying on the work of the undertaking. He thanked the proprietors cordially for the encouraging vote, and for the manner in which it had been accepted.

Mr. JOHN EVE, on behalf of his colleague in the auditorship (Mr. J. L. Chapman) and himself, also returned sincere thanks for the vote. He said he should like to refer to two impressions that had been made upon him in auditing the accounts for the past half year He had been, in the first place, struck by the prodigious amount of detail in connection with the work of the Secretary. He understood there were something like 70,000 accounts which passed through the Secretary's office, and which had to be gone through, and prepared ready for the Auditors, in the course of the six months. In addition to this, it was seen from the accounts that over 2000 consumers had been added since the corresponding half of last year. This instanced the enormous amount of detail that was involved in the work of the secretarial department. The second impression that had been made upon him was the excellent system of book-keeping adopted by the Secretary, which enabled the preparation of accounts showing the position to the last farthing.

Mr. TOPLEY, taking upon his shoulders the duty of response for both Mr. Broadberry and himself, as of the two he was the less affected with influenza, expressed the gratification of both that they had again received the approbation of the proprietors. This strengthened their hands in the best possible way, and encouraged their staffs and the workmen.

SOUTH SUBURBAN GAS COMPANY.

Half-Yearly Report and Accounts.

The following is the report of the Directors of the Company for the half year ended the 31st of December, which will be presented at the ordinary general meeting on Friday next.

Circumstances arising out of the war made it necessary for the price of gas to be raised by 2d. per 1000 cubic feet as from the meter readings for the September quarter. This reduces the dividend payable on the ordinary stock, and also the bonus to co-partners; both being dependent upon the price of gas.

The net revenue account shows that, including the balance brought forward from last half year, and the sum of £2712, being war charges on coal debited to the special purposes fund, and after providing for debenture and other interest, the amount available for dividends is £32,059 14s. 2d., out of which the Directors recommend payment of the statutory dividends: On the 5 per cent. preference stock, 5 per cent. per annum; on the 5 per cent. ordinary stock, 5⅜ per cent. per annum; on the 5 per cent. ordinary (West Kent) stock, 5 per cent. per annum—leaving to be carried forward to next half year the sum of £188 17s.

The gas sales for the half year show the fractional increase of 0·15 per cent., notwithstanding the extensive curtailment by the authorities of street and other lighting; while the demand for gas appliances of all kinds, particularly gas-fires, has been well sustained. On the other hand, the receipts for residuals have again fallen off very seriously; and the delivery of coal has greatly increased in cost, in addition to which the difficulty in obtaining adequate supplies of it has for some time past been acute.

Since the outbreak of the war, 150 of the Company's employees of all grades, including 18 members of the staff, have responded to the country's call. Of these, 57 already belonged to the Reserve or Territorial Forces; of the remainder, 6 have joined the latter, and 87 the new Army.

The Directors much regret to have to report the retirement from the Board, through continued ill-health, of Mr. Jabez Light. They have placed on record their appreciation of the valuable services rendered to the Company by Mr. Light as a Director for thirteen years and a half, during six of which he served as Deputy-Chairman. To fill the vacancy thus created, the Directors have elected Mr. Harold Gundry, barrister-at-law.

The Directors who retire by rotation at this meeting are Mr. B. R. Green and Mr. H. Gundry, both of whom, being eligible, offer themselves for re-election. One Auditor, Mr. E. W. Drew, also retires by rotation, and, being eligible, offers himself for re-election. Mr. W. G. Waller, the retiring Employee-Director, has been re-elected without opposition.

The accounts accompanying the report show that the total capital expenditure at the close of the half year (including the nominal amount added by conversion) was £1,416,066 12s. 1d., or £9861 12s. 1d. more than the receipts—viz., £1,406,205, inclusive of the premium capital. A sum of £23,173 4s. 11d. was expended on capital account in the half year; £13,603 being for additional land, and £6565 for new and additional gas-stoves. The revenue from the sale of gas was £131,067; the rental of meters, stoves, and fittings, produced £18,317; the sale of residuals, £35,055; and the total receipts were £184,707. The following were the principal items of expenditure: Gas manufacture, £94,665; distribution, £33,722; management, £8432; rents, rates, and taxes, £7863; and miscellaneous items bringing up the total to £151,243. Among the items is one of £2400 charged on account of the co-partnership scheme. The balance carried to the net revenue account is £33,464; and the amount available for dividend is £32,059.

The statements as to working show that, under the supervision of Mr. S. Y. Shoubridge, the Engineer, 69,700 tons of coal were carbonized and 464,334 gallons of oil used in the half year. The quantity of gas made was 1,126,727,000 cubic feet (213,847,000 cubic feet being oil gas), of which 1,017,458,000 cubic feet were sold and 1,028,098,200 cubic feet were accounted for. The residuals made were: Coke, 45,305 tons; breeze, 16,946 yards; tar, 677,563 gallons—the make of sulphate of ammonia being 832 tons.

BRENTFORD GAS COMPANY.

Directors' Half-Yearly Report and the Accounts.

The report of the Directors which is to be submitted at the half-yearly meeting of the Company on Friday states that, notwithstanding the reduction in outdoor and shop lighting, and compulsory earlier closing under police regulations, made in pursuance of the Defence of the Realm Act, the gas sold shows an increase of 1 75 per cent over the corresponding half year. The total number of consumers is now 108 978, as against 105,847 last year. A resolution will be submitted to the proprietors authorizing the Directors to raise a further sum of £250 000 of "B" consolidated stock, which will be required to meet the increasing business of the Company. A resolution will also be submitted to the proprietors at an extraordinary general meeting, to be held at the conclusion of the ordinary meeting, authorizing the Directors to raise a further sum of £250,000 by the issue of debenture stock or mortgage bonds. In accordance with the Brentford Gas Act, 1914, the undertakings of the Staines and Egham District Gas and Coke Company and the Sunbury Gas Consumers' Company became amalgamated with this Company as from Jan. 1, 1915.

The accounts accompanying the report show that the revenue from the sale of gas amounted to £200,740; from the rental of meters,

stoves, and fittings, to £35,023; from the sale of residual products, to £41,940—the total receipts being £277,756, compared with £280,407 in the second half of 1913. The expenditure on the manufacture of gas was £153,776; on distribution, £44,825; and on management, £9402—the total expenses being £235,277, compared with £241,428 in the six months ended Dec. 31, 1913. The balance carried to the profit and loss account is £42,479, compared with £38,979 this time last year. After providing for fixed charges and stamp duty on conversion, there remains the sum of £33,715, which, with the balance brought forward, makes £110,903 available for distribution. The Directors recommend the declaration of dividends at the following rates, subject to income-tax—viz., 5 per cent. per annum on the preference stock, 14 per cent. per annum on the consolidated stock, and 11 per cent. per annum on the new stock, 1881.

The working statements indicate that 89,234 tons of coal and 1,667,694 gallons of oil were used in the past half year in the production of 1,862,694,000 cubic feet of gas (including 781,812,000 cubic feet of carburetted water gas), of which 1,711,589,000 cubic feet were sold and 1,740,089,000 cubic feet were accounted for. The estimated production of residuals was: Coke, 55,789 tons; breeze, 8816 tons; tar, 1,182,619 gallons; ammoniacal liquor, 28,015 butts.

CAMBRIDGE GASLIGHT COMPANY.

Satisfactory Position Maintained.

Alderman W. B. Redfern presided at the half-yearly meeting of the Cambridge University and Town Gaslight Company last Tuesday (in the absence through indisposition of the Chairman, Mr. E. H. Parker); and in moving the adoption of the report and accounts, he said that it was on the day of their last half-yearly meeting that war was declared, so that they had almost six months' experience of war conditions. On the whole, they had reason for thankfulness that they had been able to maintain their position, and make sufficient profit to pay the statutory dividend. At the beginning of the war, 36 of the employees were called to the Colours, and since then some 14 more had joined the forces; so that altogether some 50 men had been withdrawn from the service of the Company. This had caused some inconvenience; but they had managed to keep the works going without any serious inconvenience to the public. One of the men was just home wounded; and another was a prisoner in the hands of the Germans. Their contracting collieries were finding that the shortage of labour was diminishing their output of coal; and with the congestion on the railways, their supply was not coming forward in such quantities as they would like. It was pleasing to be able to report an increase in the make of gas for the six months. The production had increased from 227,882,000 cubic feet for the corresponding half of 1913 to 231,550,000 cubic feet. The worst feature in the trading had been the low prices realized for coke and ammoniacal liquor. Both items showed a considerable drop from last year's figures. There was, however, an indication that sulphate of ammonia was advancing in price; and with the German production withdrawn from the market, it might be expected that the value would be still further enhanced. Coke also might reasonably be regarded as having touched its lowest figure; and it might be expected that, with the present high price being charged for coal, coke would be largely used as a household fuel. The value of tar had not been affected; and he was pleased to notice that there was a likelihood of the British dye scheme being successfully launched. With the large amount the Government proposed to devote to research work, they might confidently expect their chemists to recover for this country the important industry which had been so long in the hands of the Germans. The Company's working results had been well maintained, and reflected credit on the staff and workmen. During the half year they had added 246 new consumers, while 147 additional cookers had been fitted, and 268 gas-fires. Altogether they had reason for congratulation that, during this time of stress and anxiety, they had been able to maintain their present satisfactory position.

The report having been adopted and the dividend agreed to, the Chairman expressed the indebtedness of the Board and the shareholders to Mr. J. W. Auchterlonie (the Engineer) for the admirable way he had conducted the business, and to the Secretary (Mr. A. E. King) and the staff generally for their loyal support.

SCARBOROUGH GAS COMPANY.

Germans Cause Loss of "Twenty-Shillings' Worth of Gas."

The Directors, in their report for the twelve months ended Dec. 31 last, state that, after providing for interest charges and the dividends on the preference stock, they recommend the payment of the usual dividends on the ordinary stocks for the year at the rate of 5 per cent. per annum, less income-tax. This will leave a balance on the profit and loss account of £66 to carry forward.

The working results for the past year have been adversely affected owing to the outbreak of war during the height of the season; and the market value of residuals has greatly decreased. Thus fair comparison cannot be made on the year's accounts. The sale of gas shows a decrease of 15½ million cubic feet, as compared with the previous year, which is entirely due to the conditions prevailing since the outbreak of war. Up to that time, there was an increased sale of 6 million cubic feet, and a record year was in prospect. Since then, however, the sale has greatly decreased, both for domestic use and public lighting. A considerable number of residents have been absent from the town; and it has been impossible in many cases to ascertain the gas consumed for the December quarter. These unread meters would account for at least 6½ millions of the decrease, which quantity will be recovered when the meters are read. The decrease in public lighting represents a further 4 millions. The Company's property escaped material damage during the bombardment by German cruisers on Dec. 16 last. Shells fell close to the works; but though a splinter penetrated one of the holders the damage was soon repaired, and only about twenty shillings' worth of gas was lost. The works and offices were, and are, fully covered against war risks at Lloyds.

The Directors record with deep regret the loss which the Company have sustained through the death of Mr. Alexander Allan, their late esteemed Manager and Secretary, which took place suddenly last April. Mr. Allan had been in the service of the Company since 1901; and the Directors desire to take this occasion of placing on record their appreciation of the invaluable services rendered by him to the Company. Mr. A. Philip Allan, who acted as Assistant Manager and Secretary, was appointed by the Board to fill the vacant position.

PORTHCAWL GAS-WORKS PURCHASE ARBITRATION.

The Case for the Urban District Council.

There appeared on pp. 264-7 of last week's issue a report of the first portion of the proceedings—consisting of the case for the Company—in the arbitration which had just then taken place, at the Surveyors' Institution, Great George Street, S.W., to determine the price to be paid by the Porthcawl Urban District Council for the undertaking of the Porthcawl and District Gas Company. Two days and a short time in the morning of the third were occupied with the opening speech and evidence for the Company; and then the case for the Council [a report of which is now given] was submitted.

The Hon. J. D. FITZGERALD, K.C., acted as Umpire; and there sat with him as Arbitrators Mr. HENRY WOODALL for the Company, and Mr. FRANK JONES for the Council.

The Counsel appearing were Mr. TYLDESLEY JONES, K.C. (instructed by Messrs. W. & W. M. Bell), for the Company; and Mr. VESEY KNOX, K.C. (instructed by Messrs. Lees and Co.), for the Council.

Saturday, Jan. 30.

Mr. VESEY KNOX, without any preliminary remarks, immediately proceeded to call evidence.

Mr. *C. F. Spencer*, an accountant, said he had had a large experience in connection with the accounts of gas undertakings, and in the raising of loans for public authorities. He had, in conjunction with Mr. Robathan's firm, prepared the tables put in. These showed that the capital raised down to 1911 was £4000. Since then there had been two issues of shares, and also £2800 of debentures. In the first instance the debenture interest was 4 per cent.; but subsequently it was increased to 5 per cent. Since the last two issues of shares referred to, the whole of the capital of the Company had been secured by means of loans from the bank. The total sum which had been found in cash for the undertaking, including loans from the bank, was £19,045. The total capital expenditure of the Company to June was £19,384; or deducting the cost of the Act, it was £17,000 in round figures. It was not possible for accountants going through accounts for this length of time to really readjust revenue and capital in any thorough way.

Mr. TYLDESLEY JONES said the adjustment had been agreed in this case. It was not suggested in cross-examination of his witness that the adjustment was not to be final for the purposes of the arbitration.

Mr. VESEY KNOX pointed out that Mr. Robathan had said, taking the table as a whole, that no effort was made to adjust the figures as shown in the Company's books, in order to make full provision for plant superseded on the reconstruction of the works.

Examination resumed: The works which existed in 1910, they were told by the Engineer, had been practically superseded. These were the ones which he assumed had been equal to making 16 million cubic feet a year. The only item as a credit to capital account for these superseded works was £500 surplus appropriated in one year, and £1000 in another. Something over £7000 had been spent on the works since 1910. He had not been able to go into the question of whether or not the allowance made was sufficient for the superseded plant.

The UMPIRE: Suppose, instead of £1500, £3000 had been allowed. How would this affect the value of the undertaking which is to be valued?

Mr. VESEY KNOX: To see whether a price is fair, you must have regard to the structure and the goodwill; and as between the two, you find how much is for structure and how much for goodwill. It also affects to an extent the question whether the profits divided in recent years are likely to be maintainable. If they have not made up their accounts with proper depreciation, that is a matter for comment.

The UMPIRE: Is not the real question, Are the works as existing to-day in good order, and capable of doing the business; and, then, is the income maintainable? The books may not have been kept in the best way; this does not affect the question of value if made on that basis.

Witness, in reply to further questions, said he had seen no provision in the accounts for third-party insurance; and he thought nearly all local authorities were taking out these policies. In a works of this size, covering both works and mains, he would allow for such a purpose £15 a year; and he would also allow £1 10s. for a fidelity guarantee for the collector. The absence of a reserve fund was a drawback. In the case of a non-statutory company a reserve should be provided for unforeseen eventualities. For this, he agreed with Mr. Cash £200 a year was a fairly reasonable figure.

The UMPIRE: Would not one of the objects of such a reserve be to meet third-party claims?

Witness replied that it might be so; but there were many other unforeseen eventualities. If the Company was one in which he was financially interested, he would have liked to see £175 or £200 a year put to reserve.

Mr. VESEY KNOX: We are not going to deduct £200 a year from the revenue in this case. It would not be a permanent charge, but for a certain period—say, ten years.

Witness agreed that in this time they would have accumulated a fair reserve. No company, he went on, could operate their business pro-

perly without working capital. It was absolutely essential for both companies and local authorities. For a company to have any large proportion of its capital derived from borrowing from the bank was very bad policy. Within the last two or three years the tendency had been for rates of interest to get harder. The Urban District Council could not, he thought, in this case raise a loan under 4½ per cent. He even doubted whether next June they would be able to raise it at this price. In a company of this kind, he would not now advise any of his clients to take debentures at under 6 per cent. The recent regulations, by which all issues of capital had to have the sanction of the Treasury, made it very difficult to know what interest would have to be paid at any particular time. Between 1911 and the present date, he would take it that the difference in the interest payable by local authorities would be 16s. 3d. per cent. The difference in the security of a local authority loan and a first-class debenture in a gas company would be 1½ per cent. To give 25 years' purchase in the present case would be most unfair. His own view was that, from an interest point of view, the value of an investment of this kind, would not be more than 15 years. Fifteen years' purchase would be 6⅔ per cent.

Mr. TYLDESLEY JONES (in cross-examination): Have you been able to find in the list of sales of gas stocks already handed in by my learned friend anything that gives a revenue of 6⅔ per cent.?

Witness: I think all the companies in the list are statutory undertakings. The 6⅔ per cent. was for the particular non-statutory company now in question.

Further cross-examined: In arriving at the figure of 6 per cent. for a first-class gas company debenture, he was looking also to the future, and the possibility of increased prices of coal, labour, &c. He did not say the debentures would be affected by the price of coal; but it gave an element of some doubt to the value of securities when profits were declining.

Mr. TYLDESLEY JONES: Have you any debentures of a first-class gas company that you could offer us on this side of the table which would yield us 6 per cent.?

Witness: No. Unfortunately, I cannot carry these things about in my pocket.

Mr. TYLDESLEY JONES: I should be pleased to purchase them of you, even if I had to borrow from my bankers to do it.

Cross-examination resumed: Undoubtedly just now there were many circumstances which tended to make the financial position a very restricted one. When there were special conditions like this, there was also a tendency for people to keep their money at home and in banks, rather than invest it, as at other times. For a company that was going to be purchased in a couple of years, it would not be an unwise thing to borrow from the bank rather than raise further capital.

Re-examined: A company without a reserve would be of less value than one which had such provision.

Mr. HENRY WOODALL: As to the superseded works, what really matters is not the amount written-off, but the capital per million cubic feet. What was this figure last June?

Witness: I make it £777 at Dec. 31, 1913. That is deducting the cost of the Act. At June 30, 1914, it was £747.

With regard to the number of years' purchase, you consider that 15 years is a correct multiplier. Do you take into account the very rapid growth of the locality?—I take the position as it exists to-day, and take nothing into account for the future rapid growth of the town, which I do not consider certain.

Mr. FRANK JONES: If there had been no war, what basis would you have taken?

Witness: About 17 years. The difference between a statutory and a non-statutory company, I would take as being at least three years.

The UMPIRE: Supposing the war came to an end in any reasonable time, do you see any prospect of the money market being the same after the war as it was before?

Witness: No. Much of the capital of the nation will have gone in the war; and in addition to this, the demand for money will be very heavy for industrial and other purposes.

Mr. *Arthur Valon* stated that he had visited Porthcawl and inspected the works and district. The place was really a seaside resort, with practically no industries at all. It had recently had a very rapid increase; and a small place which expanded so rapidly in a few years, as a rule slowed-up just as quickly. The number of inhabited houses was 1125, and the proportion supplied by gas when he went into the matter was 966, which was an earlier figure than the one now given by Mr. Elias. That, however, represented over 86 per cent. of the houses supplied with gas; and the later figure would be still higher. It was a big percentage; and the increase in the number of consumers in the future would thus really depend upon the increase in the size of the town. There was no public electricity supply; and if one was introduced, the field for the supply of current was bound to be among the existing gas consumers. He had made a structural valuation of the gas-works; and this amounted to £15,421. With the exception of meters, cookers, and mains, he had not allowed depreciation. In estimating the cost of the works, he had in every case taken present prices; so that, with the exception of the depreciated items, the valuation represented what he could put up the undertaking for now. It was less by nearly £2000 than the amount shown in the accounts of the Company as capital expenditure; but there was usually an amount of capital which was obsolete.

The UMPIRE: Which shows substantially that the money is there.

Examination continued: He inspected the mains at the various holes which had been opened-up; and the condition was quite reasonably good. A leakage of 11 per cent. was high; and if all the mains were in good condition, one would not get anything like this. The places where he saw the mains were in important thoroughfares, and not in side-streets, where the pipes might not be so good. In a fair number of cases, the mains were both shallow and in an inconvenient position. Some of them ought to be relaid for these reasons. He had not, however, made any deduction on account of the state of the mains. He had valued the excess and deficient buildings and plants. In the retort-house there were five arches, three of which were fitted up, and one other ought to be—as a stand-by. The maximum daily make in 1913 was 113,900 cubic feet; and this was the amount which the works had to make. It had been suggested that the average for the maximum week should be taken; but works only equal to this would not have been capable of making the maximum day's output quoted. He took the retorts as equal to 7000 cubic feet per mouthpiece per 24 hours, which was a very reasonable figure for works with only three arches, and working six-hour charges. The ordinary life of a retort was about three years, and sometimes nearer four; and if the retorts were worn out now, it would probably be due to the fact that they had been endeavouring to get a very high make during the year on which the Company were going to base their claim. Over 12,000 cubic feet per ton, for a small works of this kind, was an exceedingly high make. In his view, there was really no excess in the retort-house; the room was needed for coal-storing. He allowed £30 for excess on the chimney-shaft, and £85 for the station-meter. On the other hand, the exhauster should be duplicated; and he agreed with Mr. Brearley as to the deficiency in the scrubbing arrangements. The gasholder capacity was inadequate, and should be equal to the maximum day's make of 113,900 cubic feet. To make up the deficiency of 41,400 cubic feet (the present capacity being 72,500 feet), he charged a proportion of the cost of telescoping the larger holder. This proportion would be £414. The retort-house was quite good; but the range of workshops and other buildings was very close to it, and would have to be pulled down and rebuilt when there was need for extending the works. So far as the works were concerned, on his valuation there was a net deficiency of £67. He had also made a valuation of the undertaking, for which purpose he had started with the profit in the year ended December, 1913. The profit made in that year was a fairer measure of maintainable profit than the profit in the year ended June, 1914. In the latter period, the Company had pushed their plant to get the best results they could; and having a new plant, the returns would be higher than when working in an average condition. At the beginning of the account year, they made a re-adjustment of their charges, which gave them an increased price for gas. This was unfair to the Council. The effect was to raise the price from 3s. 8d. to 3s. 9d. per 1000 cubic feet; and though they secured an extra revenue for the year, they would have found it desirable to reduce the price later on. He estimated that a fair allowance to meet the whole of the repair and maintenance charges would be 9d. per 1000 cubic feet. The average expenditure of the Company under this head for the three years included in the accounts was 7·38d. In these figures nothing had been allowed for replacements at the works. It had also to be remembered that the works were new; and therefore the repairs on them had not reached the average. There were also many new meters, cookers, &c.; so that one would not expect the last three years to show so high an average as would a series of ordinary years. Therefore the 7·38d. would not be a maintainable figure. He had taken the average figure of 54 undertakings for five years; and it came to just over 9d. per 1000 cubic feet for the whole of the maintenance charges—works, mains, meters, cookers, and prepayment fittings. From the profit of £1735 for the year 1913, he deducted £36 profit on sale of fittings, £338 in respect of insufficient allowance for repairs, £38 for law charges, and £16 for third-party insurance, leaving £1307, to which he added £90 for extra gas sold in the year ended June, 1914, making a maintainable profit of £1397, which he capitalized at 16 years' purchase. This gave a sum of £22,352, to which he added £108 three years' purchase of the profit on fittings, and deducted £67 for deficient works, and £1000 for working capital—arriving at a total figure of £21,393. Speaking generally, in December last about 5½ per cent. could be got in good gas concerns; and now the tendency was certainly not more favourable. This would represent just over 18 years' purchase for the best class of gas undertakings. If this was the price of a statutory undertaking, and the difference between statutory and non-statutory companies was between two and three years, it would mean about 16 years' purchase for this undertaking. Apart, of course, from the war, the return which could be obtained from gas undertakings had been increasing during the last few years. He had prepared a table of stock issues at the Mart since 1910, which bore out this fact. The absence of a reserve would affect the undertaking in the sense that the maintainable profit was maintainable under ordinary conditions; but in the case of a strike, or anything else causing a sudden rise in the price of coal, the profit might not be maintainable. It was to meet contingencies such as this that a reserve fund was kept. He made the deduction of £1000 for working capital, because if the Council were going to buy the undertaking they were entitled to everything necessary to carry it on and earn the profit which it was assumed would be earned. He had never yet had anything to do with a gas company that did not need working capital in one form or another.

The UMPIRE: Have you ever known this deduction made on a transfer?

Witness: I think that it was made in the Ashbourne case; but I really cannot say. Of course, it is quite impossible to state whether it was allowed.

Mr. TYLDESLEY JONES (in cross-examination): Have you ever claimed, in the case of a non-statutory company, on behalf of purchasers, a deduction for working capital?

Witness: No.

In cases in which you have been engaged, have you ever known it to be claimed?—No.

Further cross-examined: Within the first six weeks of working, collections from prepayment meters would begin to be made. He thought generally in the case of a rise in the price of coal a gas company would prefer to deplete the reserve fund rather than to raise the price of gas. If the Company here had had a reserve, it would have been retained by the sellers. He merely mentioned it as something which did affect the maintainable profit. He would not say that 19 years would represent the outside figure he would give for a statutory company to-day. If the present Company had had statutory powers, he would have given 18 or 19 years. Porthcawl was not on the coal measures; and repairs to mains would naturally be higher in the case of companies where there were coal-mines. A large proportion of prepayment meters, stoves, and fittings, and small consumers, generally went to make a big item for repairs. In such a case he would allow a larger sum than 9d. He thought 10 per cent. depreciation on cookers was too high. The Porthcawl works were in good order.

Mr. HENRY WOODALL: The Manager said he was only using two

beds of retorts. Do you think it would be better to light-up another bed than to run the ones in use a little harder for a short time?

Witness: Speaking generally, it would be.

Does the figure of 9d. given by you include depreciation?—Yes.

Is it fair to include depreciation?—Yes; because these ample allowances increase the security of the profit, and must affect the prices obtained for shares. I based my multiplier upon the price which is obtained for really good gas stock.

If the leakage is high, that is reflected in the accounts?—Yes; I have not made any deduction for that.

The UMPIRE: Do you, as a matter of fact, find in practice that the amount for repairs per 1000 cubic feet sold is higher in small companies than in large ones?

Witness: Yes, as a rule, it works out higher.

Mr. *J. Ferguson Bell*, who followed, stated that he had visited Porthcawl and made a careful inspection of the works and plant. The works were in fair order, and the working results satisfactory. As to the prospects of the place, he had nothing to add to what Mr. Valon had said. Building recently did not seem to have been so rapid as previously. The consumption of gas per house, for a seaside town, was heavy. There was no doubt the Council would have to put down an electricity supply works, or else a company would do so. According to the "Western Mail," shares in the Bridgend Gas and Water Company could be bought to yield £7 8s. 2d. on the investment. This was a statutory Company, who were only entitled to 10 per cent., and paid 5 per cent. The installation of electric light would probably take up the gas increase for a few years; and after this the gas business would go on increasing again. This had been the experience at Derby. With the price charged at Porthcawl, the competition of electricity would be a serious matter for lighting purposes. He would say that 11,893 cubic feet per ton of coal was a high average, and they would be fortunate if they were able to maintain it at Porthcawl. It had, of course, been secured with new retorts. He generally agreed with Mr. Valon as to the mains. There was a large proportion of small ones. He had made a structural valuation of the works; and the total was not much different from that of Mr. Valon. Some items were higher, and some were lower. Witness made the figure £15,505. Generally speaking, there was no excess of works. Another setting of retorts should be fitted up; and the existing retorts required resetting. They had not lasted so long as he would have expected; but perhaps this was because they had been rather over-pressed. He was strongly of opinion that it was wise to store at least a large part of one's coal under cover; and nowadays it was necessary to have a good stock. If they did not use the retort-house as a store for coal, they would have to build a new coal-store. Possibly the old retort-house might be used for this purpose; but it was badly situated, and it would not be large enough to hold such a stock of coal as the undertaking should possess. All gas-works, unless there was a carburetted water-gas plant, should have 24-hours' storage; and in small undertakings this was more necessary than in large ones. As a result of his calculations, he got a figure of £62 for deficiency in works. He did not think it would be possible for them to maintain the output shown for the half year to June, 1914. He had prepared a table giving the amounts spent on repairs and renewals. His own experience was that 9d. per 1000 cubic feet was necessary to maintain gas-works efficiently. The Company had not in the past spent enough. The reason he said this was that in 1910 the Company sold 13,372,000 cubic feet of gas, and the capital expenditure was £8369, or £623 per million; whereas in 1913 they sold 21,762,000 feet, and the capital had increased to £16,796, after allowing for parliamentary expenses. This was £771 per million feet sold; so that the capital during these three years had doubled, while the sale of gas had only increased 63 per cent. He would have expected it to be the other way about. With so large an increase of business, the relative capital should have gone down. There had been large sums expended in the last three years on the reconstruction and enlargement of the works; and in his opinion a great amount of this should have been charged to some renewal fund. Where a company spent sufficient on repairs, renewals, and maintenance, with the increase of business the relative capital went down considerably. If it did not, the new business was of no use to one. For works he took 4·43d.; they had expended 1·31d. This was accounted for by the fact that in the last two or three years they were working the plant out. Then they went on to new plant, and had practically no repairs. For meters, including depreciation, he put 1·27d; while they had spent less than 0·5d., which was not sufficient. Probably it was in consequence of the meters not being depreciated. On mains and services there was not much between them. For stoves they had charged to revenue, including depreciation, £153; whereas he only asked for £130. It was stated by Mr. Cash that they had agreed to write-off 7½ per cent. of the full value, which was a very fair allowance. It was practically equal to 10 per cent. of the written-down value. At his own works last year he spent 11d. for repairs, renewals, maintenance, and depreciation; the depreciation being on meters and stoves. At Sutton (Surrey) the figure for last year was 10·67d.

Mr. TYLDESLEY JONES: And the whole of the offices were built out of revenue?

Witness: None have been erected since I have been Consulting Engineer to the Company.

Further examined: A small gas company, if they had not a substantial reserve fund, ought to insure against third-party risks, and also against loss of profit resulting from an accident. He arrived (allowing for additional sales of gas to June 30, 1914) at a maintainable profit, based on 1913, of £1397. He also took 16 years' purchase, and agreed with Mr. Valon's mode of reaching this figure. In 1911, the Company issued new ordinary shares, and got a premium of £5 10s., which was sound finance; but the next year they issued a large number of shares, and allotted them to the shareholders at par. Without a reserve, he would not give so much for the undertaking as with one. In the Ashbourne case he claimed £1000 for working capital. They would not be able to earn the "maintainable profit" without such working capital. If the profits were to be capitalized, all the means for earning them should be handed over.

Mr. TYLDESLEY JONES (in cross-examination): Was the claim for working capital in the Ashbourne case your invention? Did you ever claim it before?

Witness: No; I did not.

Mr. TYLDESLEY JONES: The Umpire in the Ashbourne case (Mr. Ernest Moon, K.C.) said he had never before seen a deduction made because the buyer would not have any working capital handed over.

Cross-examination continued: The quotation he had given for the Bridgend Company's shares might be one at which shares could not be bought. He had no knowledge whether Bridgend shares could be purchased to give such a yield. From 5⅓ to 6 per cent. could be obtained in large statutory companies to-day. The difference between statutory and non-statutory companies was probably two years; but one could not take a broad line in every case. It depended on each concern.

Mr. TYLDESLEY JONES: If the yield was 5 to 5½ per cent. on good statutory companies, what number of years' purchase would you allow a non statutory undertaking such as this?

Witness: Probably 18 years.

Further cross-examined: He could not say that 3d. of his figure of 9d. for repairs and maintenance represented depreciation. Probably it would be 2d. to 2½d. In the fifteen years he had been at Derby, some five companies had been absorbed. In some cases the works were demolished entirely, and in others reconstructed. This was not done entirely out of revenue. The writing-off was done out of revenue, but from a separate fund not included in the figures quoted. When it was a question between capital and revenue at Derby, items would be charged to revenue.

Mr. HENRY WOODALL: Have you ever known the profits of a gas company to be reduced by the competition of electricity?

Witness: I cannot call one to mind at the moment.

Do you not find there is an increase in the use of gas by consumers year by year?—There is a tendency that way; but it means more expenditure.

But it is a profitable expenditure?—Yes.

Mr. FRANK JONES: What would you say would be the final condition of a gas undertaking of this size which divided all its profits, and spent 6d. per 1000 cubic feet, year in and year out, on repairs, renewals, &c.

Witness: It would go into bankruptcy, in my opinion.

This was the case for the Council.

Monday, Feb. 1.

The parties assembled at 3 o'clock for Counsels' summing-up; and so many matters were there found needing to be dealt with, that it was close upon 7 o'clock when the sitting came to an end, and the hearing of the arbitration was finally concluded.

Mr. VESEY KNOX said he felt they were in a difficulty at the present time in fixing the value of a gas undertaking. In attempting to do justice to both the buyer and the seller, there must necessarily be some amount of doubt as to the result; but he hoped he might be able to put the case of the Council in such a way as would assist the tribunal in the hard task before them. Porthcawl was a small seaside place no doubt full of hope for the future; but there were more fluctuations in a town of this kind than in an ordinary manufacturing centre. There was at least a fear, as things seemed to be going at present, that Porthcawl and the gas undertaking might not have so prosperous a time in the future as in the immediate past. Then, looking at the history of the concern, though it had been in existence for a long time, it could not really be called a long-established undertaking in its present form. In 1910, it was quite a small affair, with a sale of 16 millions; and then the Company set about putting the works in order, doubtless with the idea of going to Parliament. Subsequently the agreement was arrived at, between the Council and the Company, which resulted in the passing of the Company's Act in the form it took. Of course, the Directors knew there was a practical certainty that the Council would buy; and the evidence showed that from that time the Company, acting as though they were going to be bought, and bought by arbitration, did all they could to extend the business. It seemed a curious thing for them to have altered the price of gas in the account year in the way they did. Then they started the new works, and pressed them for all they were worth. In this way, they got together for the year which they claimed to take as the standard a very high profit—enormously more than they had made in any year before. Therefore the undertaking ought not to be regarded in the same light as one which had been making large and steady profits over a series of years. Now they came and made a claim of over £52,000; and this claim was in respect of expenditure made for the most part quite recently, and as to a large part out of borrowed money. His learned friend had tried to make a distinction between a company and its shareholders; but, for this purpose, there was no distinction at all. The money would be divided among the shareholders after paying the debt to the bank; and the tribunal had to decide what was an adequate sum to compensate them and enable them to re-invest their money in an equally good security. For the Council, certain structural valuations had been put in amounting to £15,000; and on the Company's claim of £52,000, this left £37,000 for goodwill. If they were forming a new non-statutory company on this basis, was it likely that anyone in his senses would look at such an offer? It would be considered monstrous; for, after all, what was "goodwill" in such a case? It was not the right to carry on the business, but the expectation of being allowed to carry on, without statutory authorization, a business which involved day by day a technical breach of the law in breaking-up the streets, and so on. The structural valuation was a thing which had its use in assisting the tribunal to arrive at the price; and this was the first arbitration of the kind he had known in which no such valuation had been produced for the claimants.

The UMPIRE: Your structural valuation shows the money alleged to have been spent is almost entirely there.

Mr. VESEY KNOX: It shows that of £52,000 claimed, £37,000 is for goodwill. We could set up an equally good gas-works for £15,000.

The UMPIRE: Would you not have to get a Provisional Order?

Mr. VESEY KNOX: Perhaps; but there is the fact that, as a matter

of law, we have a right to supply gas, and they have not. By section 161 of the Public Health Act, where there is no statutory company, the local authority may themselves undertake to supply gas; but where they undertake to do so, then a Provisional Order may be obtained under the Gas and Water Works Facilities Act. When you find a very large sum like this claimed for goodwill, I think it is a subject for most careful inquiry.

The UMPIRE: We all know that in practice the law has not interfered with non-statutory companies carrying on business.

Mr. VESEY KNOX: Where they have properly carried on their business, that is so. Continuing, he reviewed at length the figures that had been put in, and went on to urge the necessity of working capital to the undertaking.

The UMPIRE remarked that, with the exception of the Ashbourne case, and possibly also Swinton and Mexborough, he never remembered a claim being made for working capital.

Mr. VESEY KNOX said it occurred to him that the reason why the point had not been taken before was that until the West Ham case, it was quite common for local authorities throughout the country to make arrangements with their bankers by which one account was allowed to stand against another. In this very Act there was power to borrow for working capital, so it was known that the undertaking was going to be sold without working capital.

Mr. HENRY WOODALL: You do not suggest that is an unusual clause?

Mr. VESEY KNOX replied that he did not; but it was quite recent—only, he believed, since the West Ham case. Now it was given in almost all cases. The question of the reserve fund was very much on the same lines.

The UMPIRE: If there had been a reserve fund, it might have been applied to working capital. I do not think that you can have it both ways.

Mr. VESEY KNOX, in conclusion, maintained that, taking all the circumstances into consideration, 16 years was a proper multiplier to be used.

Mr. TYLDESLEY JONES, in reply, went through the whole of the points that had been raised by Mr. Vesey Knox. He argued that the year to Dec. 31, 1913, would be a grossly unfair one to take, because the plant by which these results were secured was superseded, and so the valuation would be based on something different from that which the Council were purchasing. He could understand his learned friend claiming some very small sum because the results of the first year's working of the new plant would be exceptionally good. As to the multiplier, he had gone through the list which had been handed in, and taking the stock sold since the war, he made the average yield £5 8s. 4d. per cent. on ordinary shares alone. Including also preference shares and debentures, the yield was far below this. It was not right to say the debenture interest did not come in. What was to be valued was the undertaking, not the shares; and the value of the undertaking was necessarily more than the value of the shares. A multiplier of 16 years for an undertaking of this kind was ridiculous; and it was a figure which he did not think any valuer for purchasers had hitherto put before a tribunal. Was the concern to be valued on any number of years' purchase based upon the existing purely artificial state of affairs—which might have come to an end before the money was paid over? The Company were compelled to sell, and at a time when no prudent investor would sell.

The UMPIRE: It is within the recollection of all of us that not long ago Consols were at 112, and are now at 68½, and maintained at this figure by the Government. Do you agree that the price of an undertaking when Consols were 112 and when they are 68½ must vary to some extent?

Mr. TYLDESLEY JONES: It must vary to some extent, but not necessarily in the same proportion.

The UMPIRE: What do you say is the general principle on which the difference should be calculated?

Mr. TYLDESLEY JONES confessed that this was a very difficult question, but said that the only difference between the position now and some years ago was really the war, and this was a temporary circumstance. It was hard to say on what lines the tribunal should proceed, if they got drawn into the vortex of the war. The only fair way was to proceed as they would have done before the war; and if they thought the increase in yield was a matter which ought to be taken into consideration, something could be allowed for this.

The UMPIRE: If your shareholders get sufficient money to give them an equal security, are they compensated?

Mr. TYLDESLEY JONES replied that he did not think this was a sufficient test. In all arbitrations undertakings were capitalized at a higher number of years' purchase than the shares themselves could be bought at. As to the introduction now of claims for working capital, it had been suggested that this was due to the West Ham case; but that case did not affect the matter at all. Such a departure in the method of valuing undertakings ought not to be made. Where a well-settled clause, with a well-understood way of giving effect to it, was put into an Act—by the assent of the gas company, if they liked—it would be unfair to the company to go and alter what had acquired a well-understood meaning. Then as to a reserve, the revenue earned was not increased one penny piece by the existence of such a fund; and it was the revenue-earning undertaking the Council were buying. The last point was with regard to compulsory purchase; and here he urged that what the Company assented to was the inclusion in their Act of a clause providing for compulsory purchase.

Blackburn Gas Engineer's Salary.—In the Blackburn Town Council last Thursday, Mr. Bates moved to refer back a proposal to pay the new gas engineer not less than £800 per annum—contending it was much too high for a town like Blackburn. After some discussion, Alderman Crossley, stating the reasons which actuated the Committee in making their recommendation, said they took into consideration the present state of the Blackburn Gas-Works, and decided that they must have a man of first-rate ability and experience. They therefore fixed a salary likely to attract such a man. Could they conceive any man, who at present got (say) £600, and was comfortably situated, undertaking the hard work of reorganization at Blackburn for anything like the same salary? The amendment was defeated.

EXHIBITION OF GAS-FURNACES AT SHEFFIELD.

Demonstration of the Brayshaw Furnace.

There was opened at Sheffield yesterday an exhibition of gas-furnaces which is probably unique in its extent, as well as in its importance to the gas industry. The project had been for some weeks under consideration by Messrs. John Wright and Co. in conjunction with Messrs. Brayshaw (whose furnace burner and other appliances were noticed in the "JOURNAL" for the 26th ult.), with the result that a scheme for a demonstration of the use of gas in industrial operations was formulated. It was not to be an exhibition in the general sense of the word, but a collection of gas-furnaces for annealing, melting, hardening, tempering, forging, &c., shown in operation, and all completely equipped with pyrometer apparatus. It was to be open for a month, during which period practical demonstrations would be given of the appliances on view, and a series of evening lectures delivered. The exhibition was opened yesterday afternoon by Professor J. O. Arnold, D.Met., F.R.S., and arrangements have been made for the following lectures:

Feb. 15.—"Pyrometry," by Mr. F. Wakeham, of Cambridge. (Chairman, Mr. J. Rossiter Hoyle, M.Inst.C.E.)

Feb. 22.—"Some Experiments upon the Quenching of Steel," by Mr. Shipley N. Brayshaw, M.I.Mech.E. (Chairman, Professor W. Ripper, D.Eng., D.Sc., M.Inst.C.E.)

March 1.—"Some Experiments in Gas Burning," by Mr. E. Russell Brayshaw, M.I.Mech.E. (Chairman, Dr. P. Longmuir.)

It may be mentioned that the Cambridge Scientific Instrument Company, Limited, have co-operated in the arrangements for the exhibition, and are showing a number of their apparatus. Messrs. Méker, of Paris, are also taking part in it. The demonstration promises to be a very great success; a large number of Sheffield manufacturers having displayed special interest in it. It will be a revelation to the visitors, many of whom will probably be quite unacquainted with the processes shown.

OLDBURY GAS UNDERTAKING ACCOUNTS.

The financial position of the Oldbury gas undertaking was discussed at a meeting of the Council on Friday, when the statement of accounts for the year ended March 31, 1914, prepared by the late Manager (Mr. A. Cooke) was presented for consideration.

Mr. TOMLINSON (the Chairman of the Gas Committee), explaining the accounts, said in connection with the revenue account the cost of manufacture was £14,585, compared with £13,826 in the previous year. The cost of repairs to works and plant was less by £836; and the cost of coal and oil was £10,314, against £8875. Distribution had cost £2135, against £1524, the bulk of the increase being due to the increased expenditure of £471 on slot-installations. The total expenditure was £19,450, against £18,139. Sales of gas yielded £16,515, against £15,728. The amount of gas sold by meter was 140,633,900 cubic feet, against 136,150,200 feet. Residual products realized £5817, against £6423. The total income was £22,548, against £22,395. There was a gross profit for the year of £3098, against £4256 in the previous year. Interest on loans and loans repaid amounted to £3295, against £3082; the increase being principally due to the interest on the new loan of £6200 sanctioned for the erection of a gasholder. The coal used in carbonizing for the year was 11,677 tons, against 11,871 tons the previous year. The coal gas made was 148,003,000 cubic feet, or 12,675 feet per ton; the water gas made was 17,539,000 cubic feet. This gave a total gas made of 165,542,000 cubic feet. The gas unaccounted for was 6·58 per cent. The total gas made showed an increase of 3·08 per cent.

Mr. G. ROBBINS drew attention to an item in the profit and loss account of £4802, balance carried to the next account, and said he wished to know exactly what this balance was, where it was, and what it really meant.

Mr. TOMLINSON said it was more than covered by the value of the stocks.

Mr. WALLACE said there was an item of £9472 balance brought from the last account; and he thought it would be interesting to know where this money had gone to, and the reason why they could not carry forward a somewhat similar amount this time.

Mr. C. H. CARDER (the Gas Engineer) said the reason for this apparent rapid decrease in the net profit was that transfers had been made to other accounts representing £4600—practically the decrease in the amount of the net profit.

Mr. H. ROBBINS said, as a member of the Gas Committee, he thought the Manager should give them a proper report showing the conditions at the gas-works, so that all could see just where they were. They had made only £98 clear profit for the year ending March last; and in all probability at the end of the present financial year they would be about £1000 behind. It was, he considered, only right and fair that every member of the Council should know the unsound position of affairs. There had been things going on down at the works that should not have been, and he suggested that the Manager should make a statement regarding it.

Mr. J. W. WILSON, M.P., said it was quite clear that the £4802 was not a matter of cash at the bank, but had been used in various directions. At the same time, he felt that it was a more correct account than the last one. The Council would see they admitted that they had been trading at a loss last year.

Mr. JONES urged that, in justice to their new Manager, they should "start with a clean sheet," and everything should be laid bare if there was an overdraft at the bank of £4802.

Mr. MACHIN said they had a £6000 overdraft already at the bank.

Mr. WALLACE said a lot of the present difficulties of the Gas Department had arisen from the fact that they had never had a proper system of depreciation.

Mr. HEATON said it seemed to him that the time had come for the Council to consider seriously the expediency of spending any more

money upon enlarging the gas undertaking. They were now charging the consumers some thousands of pounds a year more than he believed they could buy gas from Birmingham for, in order to carry on a concern which did not pay; and this he contended was not a very businesslike proposition.

Mr. JACKSON said the Local Government Board Auditor made some observations on the accounts; but he had not heard what they were.

The CLERK said the Auditor had been asked for his observations; but they were very meagre, and up to the present, through pressure of business, had not been considered by the Gas Committee. But they would be brought before the Committee at their next meeting; and they would probably report upon them.

Mr. H. ROBBINS said he wanted to know whether the gas-works were solvent or not. He did not wish to give any figures. He would prefer the Manager to give them to the Council.

Mr. G. ROBBINS: We ought to know if there is anything being hidden from the Council.

Ultimately it was decided, by fourteen votes to six, to publish the accounts.

DEFECTIVE PREPAYMENT METER REGISTRATION.

Claim for Excess Gas.

The Public Service Commission of the Second District of the State of New York have lately had before them a case which presents some features of interest in connection with the supply of gas through prepayment meters. A consumer of the Mohawk Gas Company, Mr. G. Martin, took his gas through a prepayment meter which shut off the supply when 10, or a multiple of 10, cubic feet of gas had been used. When the rate was $1·20 per 1000 cubic feet, and the coin for which the meter was constructed was a 25c. piece, every coin inserted paid for 208⅓ cubic feet, while the meter would not shut off the supply until 210 cubic feet had been used; the consumer thus getting 1⅔ feet of gas extra for each payment. The Company allowed this surplus to accumulate for sixteen months, ending February, 1912, and then they informed the consumers of what was due, and asked for payment. Mr. Martin was the only one who refused to pay, and he did so on the ground that the prepayment meter presupposed that he paid for all the gas he consumed. Last July the Company threatened to cut off the supply; and then the matter was referred to the Commission. By the contract signed by the complainant he undertook to be liable for all gas used in excess of that paid for by the meter.

The point the Commissioners had to decide was whether or not the Company had power to cut off the gas. The Chairman (Mr. Van Santvoord) held that for them to be able to carry out this remedy all they had to do was to make out a *primâ facie* case of arrears in the payment of their bills. He was of opinion that the Company had made out such a case, and that, as the Commission were not a court of law nor of equity, they were without power to prevent the cutting off of the gas. Recognizing, however, that the long delay of the Company in notifying the consumer of his arrears, and the acceptance of money thereafter without insistence on payment for the arrears, might possibly constitute a waiver of the right to enforce payment by withholding the service, he suggested that the Company should recover at law rather than cut off the gas at this late date.

Commissioner Emmet concurred in this view.

Commissioner Docker, on the other hand, held that, as the monthly variations of the meter were very small, the Company were justified in not rendering an account sooner than they did, and were not stopped from recovering. He also held that the Commission had power to act in the case. He said: "There can be no question of the authority of the Commission to hear and decide a complaint where gas service has been denied to an individual or set of individuals; and I can see no ouster of such jurisdiction when the defence may be predicated upon the claim for an unpaid bill." Commissioner Irvine concurred; but he held that the Company had acted inequitably, and deprived themselves of recourse to the remedy of cutting off the gas, which he believed should be prevented by an order of the Commission. By delaying for sixteen months the rendering of their bill, the Company deprived the consumer of the opportunity of submitting evidence that the excess charges were incorrect. He considered that to use the remedy of cutting off gas in default of payment now would be unjust and unreasonable under the section of the Public Service Commissions Law defining the Commission's powers. Commissioner Hodson agreed.

As only three of the Commissioners concurred, no order was issued.

New Gas Charges at Oldbury.

At a meeting of the Oldbury District Council last Tuesday, the Gas Committee recommended that the following prices be charged for gas, commencing from the readings of the meters now being completed: Ordinary consumers of under 50,000 cubic feet in one quarter, 2s. 9d. per 1000 feet less 5 per cent.; over 50,000 and under 100,000 cubic feet, 2s. 7d., less 5 per cent.; over 100,000 cubic feet, 2s. 5d.; gas for motive power and trade purposes, 1s. 8d. net. No alteration is at present recommended in the price charged to slot consumers; but the Committee recommend that in future slot-meters be fitted on the following terms in substitution for existing conditions: All pipes to be provided and fixed at the expense of the owner or consumer; the Committee to supply pendants or brackets up to five points of light, and if required a boiling-ring. The Committee to provide and fix the meter; cookers to be provided by the consumer if required, or may be let on hire by the Committee. Rent to be charged for cookers now fixed on slot-meter installations as from April 1, 1915. The recommendations were approved.

The Warrington Town Council have adopted a recommendation of the Gas Committee for the borrowing of £18,250 for the purpose of providing a telpher installation, new mains, &c.

WEST BROMWICH GAS UNDERTAKING.

At a Meeting of the West Bromwich Town Council last Wednesday, the Chairman of the Gas Committee (Mr. J. Brockhouse) referred to the question of the automatic lighting of public lamps in the borough, and the decision of the Committee that they did not see any reason to justify alteration. He remarked that the matter had again been raised because of certain reports in the town that the Committee had discharged some of the men in connection with the new lighting system. He wished to give an emphatic denial to these reports. It was true the system had lessened the demand for men in the lighting of the public lamps; but wherever a man had been taken from this work, another situation had been found for him. The Committee had no desire whatever to discharge any of their servants. The system of automatic lighting was not new to the country. Many towns had introduced it, though he admitted that it was not perfect. The gas undertaking had to be run on business lines, for the good of the town, and to make a profit. He draw attention to the increase in the gas-rental for the past quarter, of £366, and said for this there was a good deal of credit due to their Engineer (Mr. W. H. Johns) who had been successful in installing 300 cookers and 300 fires, which had been fixed free.

Subsequently, Mr. Bell asked whether they were perfectly satisfied with the working of the automatic lighting. He had seen lamps burning when they should not be, and *vice versâ*; and this seemed to be a fairly frequent source of complaint against them. Alderman Lawley was glad the Chairman had made his statement, because there had been a great deal of talk lately in the town about the undertaking. Mr. Anderson referred to the illuminating power of the gas, which was stated upon test to be 15 candles, and asked how they arrived at this figure. He admitted he had not the incandescent light at his place.

Mr. Brockhouse, replying, said there would either have to be an increased price for gas or an increased price for residuals. Their sales of gas had increased, it was true; but the past year had been the most disastrous period for residuals during the fourteen years he had been on the Gas Committee. This had counteracted any advantage they might have derived from the increased gas-rental. The tests of the gas were taken by a strict and fair man at the Town Hall; but there might be a deterioration by the time the gas reached Mr. Anderson's house. He advised that gentleman to have incandescent lights in his house; and he gave an instance in which, at his own works, he had substituted twelve incandescent lights for 34 flat-flame burners, and got three times the amount of light at two-thirds less expense.

CO-PARTNERSHIP AT HARROW.

The annual general meeting in connection with the co-partnership scheme of the Harrow and Stanmore Gas Company was held on Monday of last week; Mr. A. F. Phillips, the Chairman of the Company, presiding.

In the report which was read by the Engineer and Secretary (Mr. J. L. Chapman) it was stated that the past year was the third in which the scheme had been in operation. The total of the fund stood at £1342, which was an increase for the twelve months of £374. At the end of the year there were 99 members; and the average amount per member worked out at £13 11s. The bonus had been at the rate of 5 per cent. on the wages; and the total wages amounted to £8075. The bonus for the year was £404, interest £22. During the year £363 of ordinary stock had been allotted to individual members; and this stock now stood in the holders' names, and they were receiving dividends in the same way as the ordinary shareholders. The trustees held a further £615 of stock, and further allotments would be made as members were in a position to pay for the minimum amount of £10. Several members had joined His Majesty's Forces, and their bonuses have been allowed on the full amount of their wages. Under present circumstances, there was little prospect of a further reduction in the price of gas, which would entitle the members to an increased rate of bonus; but it was hoped that the price would not have to be increased. Those members who were now stockholders had a double interest in the Company—both as co-partners and as stockholders—apart from being employees, and in many cases consumers. It was with great regret that he had to announce the death of their President, Mr. A. H. Baynes. Mr. A. F. Phillips had consented to fill the position; and Dr. J. W. L. Glaisher had been elected new Directors' nominee on the Committee in his place. Mr. Phillips had been elected by the Committee as the trustee, in place of Mr. Baynes.

The Chairman and Directors were thanked for being present, on the proposition of Mr. W. Cady, who expressed the great appreciation by the employees of the co-partnership scheme, and on behalf of the co-partners congratulated Mr. Phillips on becoming Chairman of the Company. Mr. C. Chambers (the Assistant Manager), who seconded the vote, remarked on the great need existing under present conditions for being careful with the Company's materials, if they were to make co-partnership still more successful. Mr. Phillips, in thanking those present for their congratulations, said that, as Chairman, it would be his aim to further the interests of the Company and the employees, as those who had occupied the position before him had so ably done.

Gas Charges in Torquay.—It was stated recently that the Torquay Gas Company had increased the price of gas 4d. per 1000 cubic feet; and at last week's meeting of the Town Council it was agreed that, owing to the increase in the cost of coal, oil, labour, and material due to the war, the price of gas from the St. Mary Church works should be raised 6d. per 1000 cubic feet.

Public Lighting of Luton.—The Lighting Committee of the Luton Town Council have considered the question of discontinuing the lighting of streets by electric lamps and reverting to gas lighting, but have postponed further consideration of the matter until their next meeting, in order that the Borough Engineer may furnish particulars of the annual expenditure in lighting streets by electricity.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

It was mentioned in last week's "War Notes" that the Gas Committee of the Dundee Corporation had agreed to the proposal that the principal gas undertakings in Scotland should send a deputation to London to approach the Government on the question of the suspension of the Eight-Hour Act for Miners, in order to relieve the present serious delays in the delivery of coal for gas-works. At the meeting of the Dundee Town Council on Thursday, objection to the proposal was raised by Mr. Fletcher, who submitted that there was no necessity for altering the existing regulations. He was about to move that the Council should urge the Government to take over the entire management of the coal supply, when he was ruled out of order by the Lord Provost. While accepting this ruling, he continued to speak on the original question. He asked what was the use of sending a deputation to the Government to have the Act suspended when the men themselves were against any interference with the Act, which had been won for them after strenuous years of fighting. The men's hours were not to blame for any shortage in the supply of coal. He moved that the Committee take no part in any deputation. The motion having been seconded, Mr. Noble, the Convener of the Gas Committee, moved the approval of their minute on the subject. He said that at the beginning of last year the Committee arranged for a sufficient coal supply; but, owing to the shortage, they were now, at the end of nine months, three months late with their deliveries. Would they not be foolish if they did not take ways and means to get a better supply? When they went to the Railway Companies they were told that the mineowner was to blame, and presumably the mineowner would blame the miner. The proper authority to go to was the Government. As a Gas Committee they were entrusted with the supply of gas to the citizens of Dundee, and owing to the high price of coal the demand for gas was going up by leaps and bounds. This demand must be met. Mr. Fletcher's motion was lost by 21 votes to 4. Thereupon Bailie Forwell moved that the minute be remitted back to the Committee for further consideration. It was pointed out that a remit meant a delay of two months; and it was urged that it was quite time the matter was taken in hand. The motion was nevertheless carried by 16 votes to 13.

At the meeting of the Glasgow Town Council on Thursday, Bailie Irwin, replying to a question as to the Gas Department supplying coke at cheap rates to poorer citizens, said that last week there were no less than 30 tons 13 cwt. 1 qr. of coke sold at their various depôts in the city at the price of 1d. for 14 lbs., and the Gas Committee would be delighted, if the demand increased, to extend the facilities.

The inhabitants of Broughty Ferry are raising a great outcry about the quality of the gas supplied to them by the Dundee Corporation. The commotion was caused by an article in the "Dundee Advertiser;" and the result has been the usual "interviews" by a reporter and letters to the paper he represented. Before the suburb was absorbed by the city, the gas was bad; and the suppliers of it—the Broughty Ferry Corporation—were severely criticized in consequence. But it is now declared to have given really good light compared with that afforded by the Dundee gas, even when used with a mantle. Instead of being of 19 or 20 candle power, it is declared to be only 14 or 15 candle. An ex-Bailie said he was quite prepared to allow for any little handicaps under which, owing to the war, the Gas Manager might be labouring. But the curious thing was that the light was just as bad long before the war started. The inhabitants were promised gas of as good candle power as they had before joining Dundee; but they were still waiting for it. The speaker added that it had been hinted that the Dundee Corporation had met the demands of the military by sending out poorer and poorer gas, till the shopkeepers had only to lower their blinds; no other veiling of the illumination being required. And while the quality of the gas goes down, its cost, it is complained, goes up. The consensus of opinion is that there is something very far wrong, and that it requires immediate attention. This the inhabitants may rest assured it will receive at the hands of the Gas Committee and the Engineer and Manager; but the circumstances of the time call for a little forbearance on their part.

The Dumfries Town Council discussed, at their meeting last Thursday, the question of allowing a reduction in the charge for gas supplied to certain halls temporarily used as reading and recreation rooms by Territorials. Applications from the parties concerned with the halls had been received by the Gas Committee, who resolved to recommend the Council to allow a reduction of 50 per cent. in each case. On the Committee's minute coming up for confirmation, Judge Smart moved an amendment, which he had made at their meeting, that the gas should be supplied free in the case of buildings used for recreation or hospital purposes in connection with the military. He said there were a large number of Territorials in the town; and he maintained that the Council were not doing their full duty towards them. Mr. Grieve seconded the amendment. He said most people were giving what they could; and he thought the least the Council could do was to supply the gas free in these hospitals. He thought if they also gave it for halls which had been granted for the recreation of the military, it would encourage others who had the control of the halls to do the same. Mr. Farrow supported the amendment. He pointed out that this was not a local but a national matter. In times like the present, all had to make sacrifices; and he did not see why the Gas Committee should not do so, as they could well afford it. Mr. Lockerbie questioned whether the Council were legally in a position to supply gas free. He did not think they were; and he considered that they were going beyond their limit in taking 50 per cent. off the charge. The Town Clerk said he thought the view of the Government Departments was that the Scottish Office would absolve the Council in a matter of this kind. As regards the use of the ratepayers' money for such a purpose, on the merits the Council were entitled to form their own judgment; but he did not think that in this case the ordinary law of legality would apply in the way it usually did. On a vote being taken, the Committee's resolution was confirmed by 14 votes to 7.

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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Feb.* 8.

There is very little new to report in the London tar products market. Naphthalene in various forms is in keen demand; but the supply is required mostly for the production of dyes. Many briquette makers abroad, in order to obtain pitch deliveries under contracts made before the outbreak of war, are agreeing to pay a contribution towards the high freights now prevailing. Prices generally are unaltered.

Sulphate of ammonia is in specially strong demand for this and next month, the quotation for that delivery being £13 5s. net per ton for minimum 25 per cent. ammonia, naked at makers' works.

Tar Products in the Provinces.

Feb. 8.

There is no material alteration in the market for tar products. Benzols are steady, but there seems to be plenty of the product offering to meet the demand at the present moment. Solvent naphtha is firm, and good prices are being paid in all quarters. Heavy naphthas are in fair demand. Creosote is fairly steady, though there is a little more offering for near delivery. However, there is a fair amount of inquiry for export; but it is difficult to say whether this will affect the market yet awhile. In crude carbolic, sales are being made in the neighbourhood of 2s. 10d. to 3s. per gallon for the 60's quality.

The average values during the week were: Value of liquid products in one ton of tar, 17s. to 18s. 6d. Benzol, 90 per cent., naked, North, 8¾d. to 9¼d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. to 2s. 4d. Crude naphtha, in bulk, North, 5¼d. to 5⅜d. Solvent naphtha, naked, North, 1s. to 1s. 1d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3¼d. to 3 1/16d. Heavy oils, in bulk, 4d. to 4½d. Carbolic acid, casks included, 60 per cent., East and West coasts, 2s. 10d. to 3s. Naphthalene, £6 to £11; salts, 65s., bags included. Anthracene, "A" quality, 2d. per unit; "B," nominally ¾d.

Sulphate of Ammonia.

LIVERPOOL, *Feb.* 6.

Notwithstanding the continuance of the difficulty in obtaining freight room to some foreign ports, the market for this article has remained steady throughout the week. The demand for home consumption has improved, and considerable new orders have come from abroad. The nearest values to-day are £13 15s. per ton f.o.b. Hull, £13 17s. 6d. per ton f.o.b. Liverpool, and £14 per ton f.o.b. Leith. In the forward position no further first-hand transactions have transpired, but producers are very firm in their views at £14 per ton over the next few months, and at £13 for the second half of the year, f.o.b. at the principal ports.

Nitrate of Soda.

This market is still firmer, and the spot quotations are now 10s. 6d. per cwt. for ordinary quality and 11s. for refined.

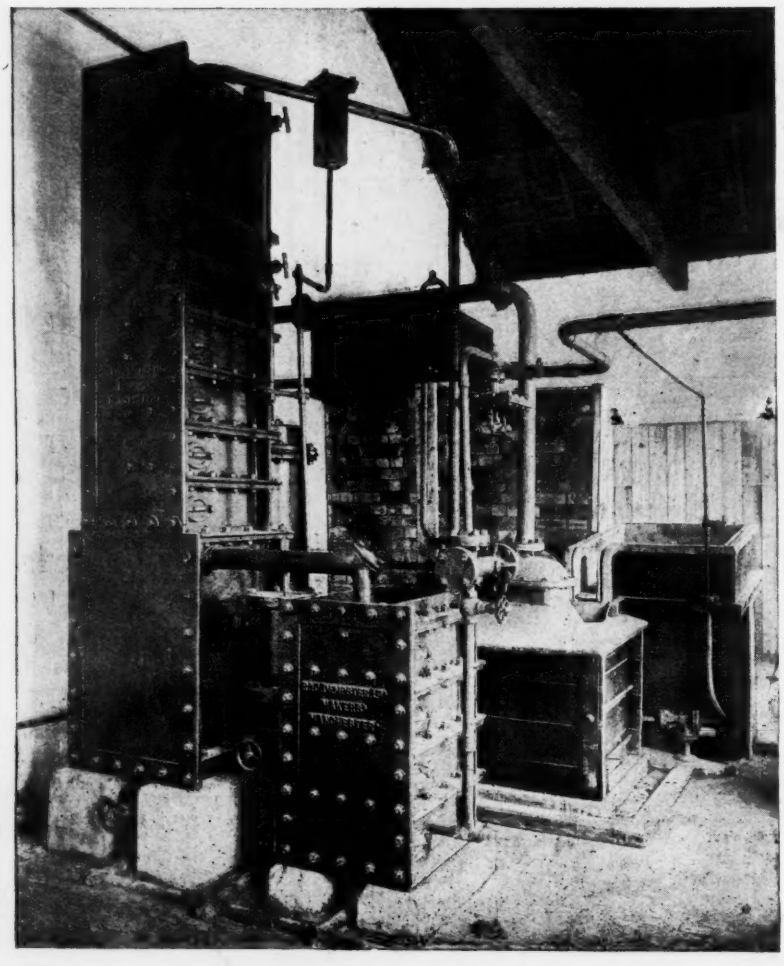
Sulphate of Ammonia.

From another source it is reported that though the market has remained steady throughout the past week, towards the close there was certainly signs of a slight weakening. Tender parcels in one or two quarters did not realize quite such good values as was the case at the beginning of the week. Outside London, makes are quoted at £13 2s, 6d.; Hull £13 12s. 6d.; Leith £14; Liverpool, £14 to £14 2s. 6d.; Middlesbrough, £13 12s. 6d. to £13 15s.

COAL TRADE REPORT.

Northern Coal Trade.

There is a fuller demand for coal, and the shipments from the northern ports are a little heavier, though still below the average at this season. In the steam coal trade the inquiry is strong, especially from France and Italy. Best Northumbrian steams are from 13s. 9d. to 14s. per ton f.o.b.; second-class steams are about 12s. to 12s. 6d. per ton; and steam smalls are 8s. 3d. to 9s. 6d.—the latter class being in good request. Work at the collieries is better; but at most of the pits in the North recruiting has reduced the numbers of miners employed. In the gas coal trade the demand is steady, both for home and export, and steamers seem coming more freely to the ports, though there are high freights still existing. Best Durham gas coals are now 12s. 6d. per ton f.o.b.; second-class gas coals are 11s. to 11s. 3d. per ton; and the current quotation for "Wear Specials" is from 13s. to 13s. 3d. per ton f.o.b. There are more inquiries now for gas coals for forward delivery; and one lot of 10,000 tons has been sold for shipment from April to August—the price rumoured being 14s. per ton f.o.b. Some best gas coals have been sold for Genoa at 12s. 6d. per ton f.o.b., even though the freight to the port is still 37s.; but the delay in the delivery there is less than it was. At the same time, there ought now to be some lessening of the consumption of gas coals by the great companies, though stocks may have to be replenished. On the whole, however, the demand is being more readily and fully met than it was three or four weeks ago. If there were lower freights, gas coal would probably be heavily shipped. In the coke trade, there seems a better inquiry for gas coke, and the quotation appears to be rather higher at 11s. 9d. to 12s. 9d. per ton f.o.b. in the Tyne.



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South Staffordshire Mond Gas Company.

The Directors of the South Staffordshire Mond Gas (Power and Heating) Company, in their report covering the operations during 1914, state that the number of customers supplied increased during the twelve months from 145 to 159, and the quantity of gas sold was nearly 10 per cent. more than in 1913. The profit on revenue account is £13,650—£2397 more than for the previous year. Unfortunately, the price of sulphate of ammonia (the Company's chief bye-product) was low throughout the year. Since the outbreak of the war, shipments have been very restricted; and special arrangements also had to be made for the disposal of the tar. The first effects of the war resulted in a serious shrinkage in the demand for gas during August and September; but with the exception of these two months, the demand increased continuously throughout the year. A large number of the customers are engaged upon Government work; and the demand for gas is now so heavy that, owing to the great difficulty in obtaining adequate fuel supplies, the Company have had to request customers to curtail their requirements, and have also had to decline to make fresh connections. Adding to the gross profit for the year the balance brought forward from 1913 and bank interest, there is a total sum of £15,398; and after deducting interest on debenture stock, there remains £8982. Out of this, the Directors propose to pay a dividend of 6 per cent. (less tax) on the preference shares, and to carry forward £4032. In view of the difficulties as to fuel supplies, and also taking into consideration the general conditions now prevailing, the Board recommend that no dividend be declared on the ordinary shares.

Gas Light and Coke Company and the Panama Exhibition.—We learn from the "Co-Partners' Magazine" of the Gas Light and Coke Company that the Directors have decided to have an exhibit in the Chemical Section of the Panama-Pacific Exhibition. It will consist of a collection of the residual products of gas manufacture arranged in a mahogany show-case designed and constructed by the Company's own staff of carpenters. The display has been prepared at the products works at Beckton.

"Parlous Condition" of the Redditch Electricity Undertaking.—During a Local Government Board inquiry at Redditch, regarding an application by the Council to borrow £28,000, instead of £18,000 originally proposed, for the purposes of the electricity undertaking, Mr. H. R. Hooper (Inspector) referred to the absence of members of the Council. The undertaking, he said, was in a parlous condition; and as the matter concerned the councillors, they should have endeavoured to attend. It was pointed out, however, that some of the members were working men, and therefore could not be present. Mr. Hooper, alluding to the unfortunate history of the concern, said it had drawn from the rates £24,000. The extra money, it transpired, is needed to furnish a supply of 2,000,000 units of electricity a year to the Redditch works of the Birmingham Small Arms Company.

A Good Position at Newport (Mon.).

In the unavoidable absence of the Chairman and Deputy-Chairman, last week's half-yearly meeting of the Newport (Mon.) Gas Company was presided over by Mr. G. Geen, who, in moving the adoption of the report and accounts, said the revenue account showed a balance of £7605, which was carried to profit and loss account. This was £959 less than in the corresponding half year, and was entirely due to the effect of the war upon the returns from residuals—especially coke, the exports of which had been greatly restricted. In spite, however, of drawbacks, the Company were in a position to recommend the payment of the usual dividends. Fortunately, they had not, like many places, including London, had to resort to the raising of the price of gas; and they had every hope that they would not be compelled to do so. In the course of a comparatively few years the price of gas had been reduced at Newport from 3s. 8d. to 2s. 11d. per 1000 cubic feet; and if they could buy coal at the price they were paying when they were selling gas at 3s. 8d., they would be able to charge 2s. 8d. or 2s. 9d. The reduction in the price of gas had been due entirely—or almost entirely—to improvements in manufacture and economies of management. Many of them knew that a variation of 1s. a ton in the price of coal meant a variation of 1d. per 1000 feet in the price of gas. He thought they were in a fairly satisfactory position, having regard to all the circumstances. There was a reduction in residuals all round of £2276; but there were indications that they would get better prices for residuals than during the last half year. They had sold more gas than during the corresponding period of last year to the extent of 1½ million cubic feet; and they had put in 178 new services during the six months. Over 30 of the employees had been called up or had enlisted for military service; and the Company's contributions to the wives and families amounted to about £600 a year. He would like to bear testimony to the loyalty and efficiency of the staff; and when they looked at the balance-sheets of other companies, he thought they might congratulate themselves upon the result of the half-year's work. It was better than the Directors anticipated. When the report had been adopted and the dividend declared, the shareholders warmly acknowledged the work done by the Directors, the Engineer (Mr. Thomas Canning, J.P.), the Manager (Mr. J. H. Canning), the Secretary (Mr. T. H. Hazell), and the other members of the staff.

Preston Public Lighting.—The new system of lighting the central thoroughfares of Preston, preparations for which commenced in August last, is almost completed. Referring to it, the "Northern Daily Telegraph" says: "The brilliant system of gas lights, which has produced such satisfactory results in many populous towns, has already won much favour at Preston, where the thoroughfares at night are often crowded. The lamps, 150 in number, are attached to the tramway standards, thus illuminating a considerable area." The new system is the result of tests made last year—electricity and gas being tried alternately.

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Urban Council and the Skegness Gas Undertaking.—The scheme of the Skegness Urban District Council for obtaining parliamentary powers for the purchase of the local gas undertaking has been approved by the ratepayers—511 votes in its favour and 89 against.

Sale of Gas Shares in Melbourne.—Much interest was evinced locally last December in a sale by auction of 10,000 new shares of £5 each in the Melbourne Metropolitan Gas Company. The bidding was eager; and the total amount realized by the sale was £98,379. Sales were effected at rates ranging from £9 15s. to £9 19s. per share. The new shares rank for dividend as from June 30 last.

Nottingham Slot-Meter Robberies.—At the Nottingham City Quarter Sessions, last Tuesday, the Recorder (Sir Ryland Adkins) sentenced Leonard May, a waiter, to seven months' imprisonment; the accused (who had previously been convicted, and to whom, it was stated, such thefts were common) having pleaded guilty to entering a dwelling-house and stealing 2s. 1d. from a prepayment meter. He endeavoured unavailingly to play on the sympathy of the Court by a promise to join the army, if allowed one more chance. Counsel for the prosecution, referring to the theft, whimsically observed that the search for copper was causing a lot of trouble all over the world.

Birkenhead Gas-Works Extension Scheme.—The Gas Engineer (Mr. T. O. Paterson) has submitted to the Gas Committee of the Birkenhead Corporation a statement as to the expenditure over and above the amount sanctioned by the Local Government Board on certain works in connection with the gas undertaking extension scheme sanctioned by the Council some time ago. In respect of the scheme, formal application was made to the Board for borrowing powers for £78,790; and the estimated excess expenditure to complete the work is £10,600. The Committee resolved to make application to the Board for sanction to borrow this further sum; the amount to be repaid within periods similar to those applicable to the original loan.

New Carbonizing Plant for Keighley.—The Keighley Town Council have adopted a recommendation by the Gas Committee to accept the tender of Messrs. Drakes Limited, of Halifax, for the installation of new carbonizing plant at the gas-works, including retort-benches, steelwork, chimney, bench bracings, coal-handling plant, coal-hoppers, stoking machinery, and electrical power generating plant. It was explained by Mr. Harrison that the amount of the tender was £21,495; and it is proposed by the Committee to meet the cost out of revenue. The work is in the nature of a renewal of plant rather than an extension; and they reckon that it will effect a saving in working of £2000 per annum as compared with the old system. Mr. Albert Smith said the Committee, in bringing this matter forward, made no mention of the new gasholder, which had cost them £17,000. He was not prepared to vote for depleting the funds of the Corporation to such an extent at the present time. They were estimating for a deficit of £600 next year for the first time in the history of the gas department. He moved, as an amendment, that the matter be deferred for a year. This, however, was lost.

Kirkby-in-Ashfield Gas-Works.—It having been determined to erect a gasholder at these works, it was reported by the Clerk, at the last meeting of the Urban District Council, that steps had been taken to raise a loan of £5500 for the purpose. The contract with Messrs. Dempster for the construction of the new holder had been executed; the date for completion being fixed for Oct. 31 next, and the Council agreeing to consider the question of an extension of time should it become necessary.

Aldershot Gas, Water, and District Lighting Company.—The accounts for the half year ended Dec. 31 show that the total revenue during this period was £44,135, and the expenditure £34,422, leaving a surplus of £9713. After providing for the dividends on the consolidated preference stock, and interest on mortgage, special loan, and debentures, the Directors recommend a dividend for the half year at the rate of £5 18s. per cent. per annum on the "A" stock, £4 8s. per cent. per annum on the "B" stock (these rates being in accordance with the sliding-scale), and 5 per cent. per annum on the "C" consolidated stock—all less income-tax. The Directors remark in their report that the war has added greatly to the expenses, in ways too numerous to mention; but it is hoped, with the support of the loyal body of employees, to continue a progressive course. The sales of gas, exclusive of works and special contracts, show an increase of 10·7 per cent.; and the revenue from water has also increased. The electricity station at the Northcamp and Farnborough works commenced operations on Dec. 19 last.

Stone Gas and Electricity Company, Limited.—Moving the adoption of the report and accounts for 1914 at the annual meeting of the Company, the Chairman (Mr. J. Kendrick, J.P.) stated that the returns were the best ever presented in the 61 years of the Company's existence; and though there was a slight decrease in the sale of gas, the quantity consumed for lighting, heating, and cooking had increased, and the decrease was shown in that used for power purposes. The working expenses were rather less than in the previous year. The leakage had again been materially reduced; but he did not consider that much further improvement could be shown in this department, as each year since the present Engineer (Mr. T. W. Saville) had been appointed there had been a reduction, until it had got to practically a minimum quantity. The Company had been very fortunate in their returns from residuals. They had no stock of coke, and were even purchasing from other places to supply their customers. Last year the Company secured an Act giving them electrical and other powers; and in this a purchase clause was inserted. In view of this, the Council had already retained the services of Mr. Isaac Carr, of Widnes, who had inspected the works. The report was adopted, the usual dividend of 10 per cent. was declared, and a vote of thanks was passed, in response to which the Chairman remarked that the success of the year's working was due to a large extent to the energy displayed by Mr. Saville, their able Secretary and Manager, in guarding the Company's business and interests.

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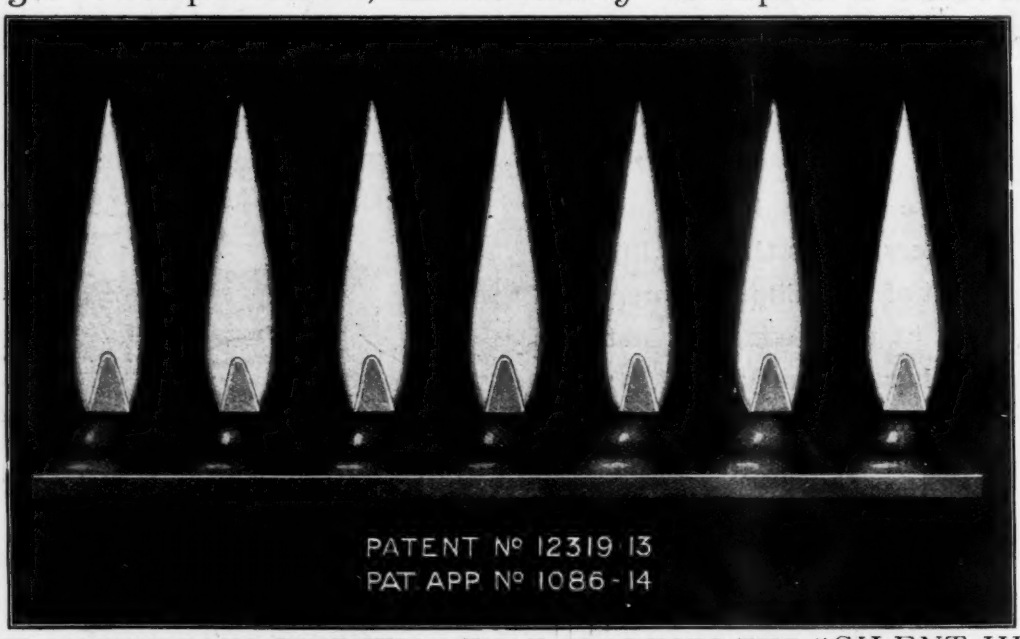

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New Holder for Walsall.—The Wallsall Gas Committee have accepted the tender of Messrs. Clayton, Son, and Co., of Leeds, to provide a new holder (from the plans of Mr. F. S. Cripps), at a cost of £11,396. The work is to be completed by September, 1916; and the cost will be defrayed out of the gas-works reserve fund.

Doncaster and Municipal Trading.—A poll of the electors of Doncaster has taken place upon the Corporation Bill, the objects of which have been dealt with in the "JOURNAL." The tradesmen of the town made a determined effort to defeat clauses 27 and 129, which they contended would permit municipal trading in water and electric fittings, though no objection was taken to the general principles of the Bill. In the result, both clauses were rejected by large majorities.

Increased Sales at Dorchester.—The report and accounts of the Dorchester Gas and Coke Company, Limited, for the past half year show that the increase in the sales of gas was equal to 7¼ per cent. as compared with the corresponding period of 1913; but owing to the largely increased cost of coal and labour, the profits earned are considerably less. In common with many other industries, the operations of the Company have been carried on with considerable difficulty during the past winter; no less than thirteen of their employees having joined the Colours.

Ormskirk Gas and Electricity Bill.—The Ormskirk Urban District Council recently held a special meeting for the purpose of deciding whether or not they should oppose the Bill of the Ormskirk Gas Company. They determined by five votes to two to do so; but the resolution was declared invalid because there was not a majority of the whole of the members of the Council (who number twelve) in favour of opposition. Thereupon the ratepayers held a meeting and unanimously urged the Council to oppose the Bill; and so another special meeting of the Council was called. This time the resolution to oppose was carried by five votes in favour to none against.

Lighting of the Cambridge Guildhall.—Complaints having been made of the insufficient lighting of the Guildhall at Cambridge, the Mayor (Mr. W. L. Raynes) communicated with the Engineer and Manager of the Gas Company (Mr. J. W. Auchterlonie), who admitted that the present system was bad, and offered to instal two "Nonpariel" ventilating inverted incandescent gas sun burners free of charge on trial, and stated that if the experiment was considered to be unsuccessful the Company would remove the new burners and reinstate the old ones without charge. If, on the other hand, it was decided to retain the new burners, the Corporation would be asked to pay the cost in accordance with the estimate of the makers, Messrs. James Milne and Son, amounting to £63 15s. It is estimated that the consumption of gas by the present sunlight burners is about 600 cubic feet per hour, with an illuminating power of about 1400 candles, and that the consumption by the proposed sunlights would be about 220 feet, with an illuminating power about three times greater than at present. The Law Committee were of opinion that the offer of the Company was a very fair one, and therefore recommended its acceptance by the Council, who have agreed to this.

APPLICATIONS FOR LETTERS PATENT.

745.—DAVISON, E. J., and TOOLEY, P., "Chequer bricks for carburetted water-gas plants." Jan. 18.
762.—BROTHERTON, W. J., "Extension-shelf for gas-oven." Jan. 18.
776.—SOUTH METROPOLITAN GAS COMPANY and THOMAS, J. S. G., "Photometers." Jan. 18.
794.—COLE, E. S., "Flow meters and recorders." Jan. 18.
795.—HUMPHREY, H. S., "Instantaneous water-heating casings." Jan. 18.
844.—BEARD, G. F. H., SCOTT, J. W., and R. & J. DEMPSTER, LIMITED, "Controlling the flow of gas in purifiers." Jan. 19.
859.—KENT-JOHNSTON, A. M., "Controlling lamps." Jan. 19.
880-1.—BOOTY, P. C. P., "Air-gas machines." Jan. 19.
892.—GILL, W. A., "Gas-engines." Jan. 19.
933.—TURNER, W. D., "Mixing gas and air." Jan. 20.
1004.—CARS, B., and PALMER, W. D., "Mantles." Jan. 21.
1005.—CARS, B., and PALMER, W. D., "Obtaining illumination by mantles." Jan. 21.
1045.—CLIMIE, W., "Purifying gas." Jan. 22.
1094.—BATEMAN, J., "Gas-stoves." Jan. 22.
1206.—BURROWS, L. P., "Treating coal." Jan. 25.
1329.—PORGES, P., and STRACHE, H., "Carburetting water gas." Jan. 27.
1335.—PHONOLUX LIMITED, and KILLAR, C. F., "Incandescent mantles." Jan. 27.
1336.—PHONOLUX LIMITED, and KILLAR, C. F., "Incandescent gas lighting." Jan. 27.
1357.—TURNER, E., "Burners for heating." Jan. 27.
1360.—GROB, H., "Inverted gas-lamps." Jan. 27.
1380.—MACLAURIN, R., "Treating gas" Jan. 28.
1416.—CANOVA, V., "Controlling burners." Jan. 28.
1434.—WILLETT, H. W. H., "Generating gas." Jan. 28.
1489-90.—MELAMID, M., and GROTZINGER, L., "Treating tar or tar oils." Jan. 29.
1537.—CAMPBELL, F. W., "Incandescent burners." Jan. 30.
1544.—SHEPHERD, H., and HAWORTH, T., "Acetylene burners." Jan. 30.

Street Lighting Precautions at Burton-on-Trent.—A special meeting of the Burton-on-Trent Corporation Gas and Electricity Committee was held last Friday to consider the question of precautionary measures in the event of possible air raids, particularly as to reducing the lighting of streets and shop-fronts. The Committee decided that for the present the whole of the street lighting should be reduced one-half, and that lamps in the thoroughfares, notwithstanding the reduction in the extent of the public lighting, should be shaded so as to prevent any light from being seen above the horizontal. The Committee also strongly urged tradesmen to dispense altogether with outside shop illumination.

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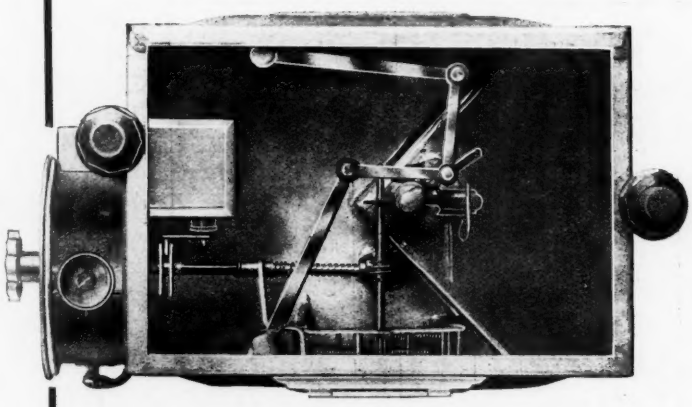

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Swansea Gas Company.

At the Annual General Meeting of this Company last Tuesday, Mr. John Glassbrook, who presided, stated that the business of the Company had, to some extent, been affected by the war, particularly in the poor markets for residual products. As to coke, it was the Company's intention within the next week or so to undertake the delivery of coke, which was a low-priced smokeless fuel, in bags to customers' houses in Swansea. The prices of coal and raw materials had largely increased, and this would have to be taken very seriously into consideration in the near future. Meanwhile the Company had been fortunate in making some favourable contracts during the middle of last year, which would help them at the beginning of the present year. The business transacted at the Company's show-rooms had entirely justified the step taken by the Directors. The installations of high-pressure gas in High Street, which were much admired, were only the beginning of a larger scheme for endeavouring to improve the lighting in the shopping areas of Swansea. Full parliamentary powers having been given the Company on their new site at Morriston, preliminary operations had already commenced, and it was the Board's intention to proceed, as soon as circumstances permitted, with the construction of a large gasholder. The Company had very considerably increased the number of their consumers during the year, and more than 1000 additional cookers had been put into use. In connection with the latter, the Chairman mentioned that the whole of the cooking at the Drill Hall and the Old Training College for the military billeted in the town was done by gas, the increase in the demand for which was maintained. The balance of surplus profits carried to the next account amounted to £14,671. The motion for the adoption of the accounts was carried unanimously, as was also one declaring the usual statutory dividend.

Mr. W. L. George, the senior representative of Messrs. Falk, Stadelmann, and Co.'s Glasgow branch (who has for the last twelve years represented the firm in Scotland and the North of Ireland), has been transferred to the headquarters of the Company in London, and will for the future represent them in London and the Provinces—calling exclusively upon gas companies and lighting authorities.

Gas and Electrical Competition at Leeds.

A resolution has been carried by the Leeds City Council embodying a suggestion for the formation of a Joint Sub-Committee of four members each from the Gas and Electricity Committees to consider and report from time to time on questions relative to the sale of their commodities to consumers, with a view to avoiding overlapping and competition. The proposal was opposed by Alderman W. Penrose Green, who pointed out that five members of the Gas Committee were members of the Electricity Committee, and thought this fact did away with a great deal of the argument for the scheme. Neither of the departments feared reasonable competition, which he thought was good for both, because it gave efficiency and a better and cheaper commodity. The work of the two Committees was sufficiently great at the present time without the setting up of another Committee; and the duty of the members who sat on the Committees was to prevent overlapping. Alderman Ford contended that when members sat on two Committees they did at one particular time the work of the Committee they were then sitting on, and not of the other Committee, which did not then engage their attention. There had been a great deal of "unseemly competition" between the gas and electricity undertakings; and the proposition would go a good way towards reducing this. Mr. Hugh Lupton (speaking as the Chairman of the Sub-Committee who deal with electricity) expressed the opinion that the price that should be charged for electricity should leave only a small margin of profit after the cost of generation and capital charges had been paid. He thought the proposal would tend to create a monopoly, which would be disastrous. Alderman Ratcliffe agreed with the resolution, and said there was not that supervision at present which would be obtained by the appointment of a Joint Committee.

Enniskillen and Coal Shortage.—At a meeting of the Enniskillen Urban District Council last week, Mr. W. C. Trimble mentioned that the town gas supply was threatened owing to the Gas Company's coal running short, and the impossibility of getting cargoes across the Channel under present conditions. Mr. Crumley suggested they should get Irish coal; but Mr. Trimble remarked that as it was anthracite it was of no use for gas-making purposes. No action was taken.

GAS COMPANIES IN THE STOCK EXCHANGE.

Business on the Stock Exchange last week was, on the whole, a good bit quieter, and the general tendency was rather towards easier figures. The breath which blew cool upon the markets and tempered their ardour seemed to come from across the Atlantic—Wall Street not being in a buoyant mood. Still, there was a fair amount of investment buying in evidence, though, while there is so much talk of reduced minimum prices, one cannot be surprised if some hold back on the chance of getting in at something nearer bedrock figures. Stock Exchange rates came in for some more criticism last week—this time at the hands of a City legal functionary. Whatever be the merits of the case, fair discussion will do no harm. Complaints, too, were made of a Provincial Exchange being open for official business until a later hour than the London Exchange. Uniformity in this respect would appear to be desirable under existing circumstances. Business in gas securities shared to a great extent in the reduction of activity affecting markets in general, and the only issue which showed any animation was Gas Light ordinary, which was active and firm. Most of the rest merely marked-time at about the old figures of the week before.

The bargains done for cash during the week were as follows: On Monday, Commercial 3½ per cent. 98, Gas Light ordinary 93, 93⅞, ditto preference 91, Primitiva preference 4½. On Tuesday, Gas Light ordinary 93, 93⅛, 93¼, 93⅜, ditto debenture 71, Melbourne debenture 99⅞. On Wednesday, Bournemouth "B" 14⅛, 14⅜, ditto debenture 93, 93½, Continental Union 70½, 71, Croydon "C" 7 per cent. 215, 216, Gas Light ordinary 93¼, 93⅜, South Metropolitan 100½. On Thursday, Gas Light ordinary 92⅛, 93, 93¼, 93½, 93⅝, ditto maximum 72½, 73, ditto debenture 71, South Metropolitan 100, 100½. On Friday, Gas Light ordinary 93¼ was the only bargain. On the local Exchange, Liverpool 5 per cent. ordinary was dealt in at 102½. On Saturday, Gas Light ordinary 93, 93⅛, ditto maximum 72, ditto preference 92½, ditto debenture 71. The Money Market continued very easy. Bankers' deposit rates were lowered to 1½ per cent. on Thursday.

Bank rate (fixed Aug. 8) 5 per cent.; last year, 3 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING FEBRUARY 6.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
1,551,868	Stk.	April 8	2½	Alliance & Dublin Ord.	59 –64	3 18 2	59—59½
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—73	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd. . . .	5⅛–6⅜	5 17 8	..
50,000	10	Feb. 26	16	Bournemouth Gas and Water { 10 p.c. . .	29 –30	5 6 8	..
878,480	10	,,	7	{ B 7 p.c. . .	15—15½	4 10 4	14⅛—14⅜
95,000	10	,,	6	{ Pref. 6 p.c.	13½—14	4 5 9	13⅜—13⅝
—	—	—	—	Deb. . .	..	—	93—93½
880,000	Stk.	Feb. 26	14	Brentford Consolidated	361—366	5 5 3	..
880,000	,,	,,	11	Do. New . . .	204—209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb. .	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208–213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk. .	154—159	5 0 8	145—145½
530,000	20	Mar. 26	19½	British	41–45	5 11 1	42—42¼
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88–93	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb	85–87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1¼–2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref. .	4–6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70–75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord. . .	103—110	4 10 11	
1,513,280	Stk.	Feb. 12	5⅝/4	Commercial 4 p.c. Stk.	106—108	5 1 2	99½
560,000	,,	,,	6½	Do. 3½ p.c. do. .	103—105	5 1 6	98
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½–71½	4 3 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76–79	5 1 3	70½—71
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon C 7 p.c.. . .	..	—	215—216
4 2,270	Stk.	—	6	Derby Con. Stk. . . .	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk. .	102—104	3 16 11	
1,032,180	10	July 29	10	European, Ltd. . . .	17½–18⅞	5 11 1	18½
1,334,910	Stk.	Feb. 12	1/17/4	Gas { 4 p.c. Ord. . .	93–102	4 15 6	92½–93⅜
2,600,000	,,	,,	3½	Light { 3½ p.c. max. .	76–79	4 8 7	73—73
4,064,215	,,	,,	4	and { 4 p.c. Con. Pref.	96–99	4 0 10	91—92½
4,674,850	,,	June 11	3	Coke { 3 p.c. Con. Deb.	73½–74½	4 0 6	71
238,710	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87–89	5 12 4	83—89½
70,030	10	April 29	11	Hongkong & China, Ltd.	16½–16⅞	5 11 4	..
—	—	—	—	Hornsey 7 p.c. . . .	..	—	160
131,033	Stk.	Mar. 12	7½†	Ilford A and C . . .	151—154	5 2 4	..
65,780	,,	,,	6⅜†	Do. B	115—118	5 8 0	..
65,530	,,	June 26	4	Do. 4 p.c. Deb. . .	92–94	4 5 1	..
4,940,033	Stk.	May 14	9	Imperial Continental .	150—160	5 12 6	82—83½
1,235,030	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.	84–86	4 1 5	..
233,242	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c. .	119–121	5 7 6	..
561,030	Stk.	Feb. 26	10	Liverpool United A .	211—213	4 13 11	..
718,100	,,	,,	7	Do. B .	146—148	4 14 7	..
955,043	.	June 26	4	Do. Deb. Stk.	97–99	4 0 10	..

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	4½–4⅝	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	4 9 1	99⅞
541,920	20	May 28	4	Monte Video, Ltd. . .	11½–12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½–99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—15	5 2 8	
800,000	Stk.	May 14	8	Oriental, Ltd. . . .	117—122	6 11 2	117
60,000	5	Mar. 26	10	Ottoman, Ltd. . . .	7½–7⅞	6 9 0	..
60,000	50	Feb. 26	13	Porisea, Island B . .	128—131	4 19 8	..
100,000	50	,,	12	Do. C . .	118—121	4 19 2	
249,980	5	April 29	8	Primitiva Ord. . . .	5½–6	6 13 4	4½—5⅛
499,960	5	June 26	5	,, 5 p.c. Pref. .	4½–5	5 0 0	4½
521,600	100	June 2	4	,, 4 p.c. Deb. .	91—93	4 6 0	85½—86
—	—	—	—	,, ,, ,, 1911	..	—	85
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	85
150,000	10	May 14	6	San Paulo { 6 p.c. Pref.	10½–11	5 9 1	..
125,000	50	July 1	5	{ 5 p.c. Deb.	47–49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	Do. B	222—224	4 9 3	..
523,500	,,	,,	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African . . .	10½–11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	4 16 8	100—100½
1,295,445	,,	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	70½–71½
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	108
60,000	,,	,,	5	Do. 5 p.c. Pref. .	110—112	4 9 3	.
—	—	—	—	Do. West Kent. . .	..	—	92
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	107½
629,740	Stk.	May 14	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½†	Tottenham District { A 5 p.c. .	135—138	5 8 8	
742,275	,,	,,	6½	{ B 3½ p.c. .	115—117	5 2 7	112
181,255	,,	June 26	4	{ 4 p.c. Deb.	87–89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd. . . .	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93–95	5 5 3	..
236,476	Stk.	Mar. 12	6	Tynemouth, 5 p.c. max.	108½–109½	4 11 4	..
80,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	,,	,,	6⅜	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

Penistone Water Supply.—Mr. F. O. Stamford held an inquiry at Penistone last Friday in regard to an application made to the Local Government Board by the Urban District Council for authority to borrow £1000 (to be increased to £1500) for purposes of water supply. There was no opposition.

Leeds Water Supply.—The first of a series of lectures, designed to illustrate the municipal undertakings of the Leeds Corporation, was delivered in the Philosophical Hall last Friday night by Mr. C. G. Henzell, the Water-Works Engineer, whose subject was "The Water Supply." Mr. Henzell dealt mainly with the growth of the water undertaking up to the year 1911, the whole subject, as he explained, being too large to be covered by one lecture. He traced the rise of this important part of a city's responsibilities from the year 1694, when the city received its water supply by pumping direct from the River Aire above Leeds Bridge. In 1754 the supply was drawn by engines from The Calls, and 2 gallons per head per day represented the local consumption, as against 23 gallons at the present time. There was then no filtration, and the water must always have been polluted.

On Saturday night, smoke was seen issuing from the Newport (Mon.) Town Hall, and it was found that the carved and decorated wooden ceiling of the Council Chamber was on fire. The brigade and police speedily got to work; and the outbreak was extinguished. The fire was thought to be due to the fusing of electric wires in the well for the ladder-way leading to the roof. Great damage was done by water.

A fire occurred at the offices of the Parkinson Stove Company, Limited, in Stour Street, Birmingham, last Friday; but fortunately the works remain intact, and as temporary office accommodation has been provided, orders will be dealt with uninterruptedly, and business will proceed as heretofore.

The Huddersfield chemical works of Messrs. Read Holliday and Sons were last week the scene of a disastrous explosion, by which five men were severely burned—one dying shortly afterwards. The men were engaged in the colour-grinding room when, from some unexplainable cause, the cylinder of the machine burst, and the place was filled with flame.

A message through Reuter's agency states that an engineer who was sent to Ugarte in the Asturias to report upon a column of fire which suddenly sprang up in a cornfield while a shaft was being bored, and was believed to be a petroleum gusher, declares that the flame was from a gas which is capable of being very useful to various industries should it prove to be permanent.

A reward of £10 is being offered by the Ossett Corporation for information which will lead to the conviction of persons who are responsible for a malicious attempt to damage the new plant at the gas-works. Though no information is officially given as to what happened, it is, a correspondent writes, understood that the coal elevator and one of the valves connected with the retorts had been tampered with in a way which could only point to deliberate intention to cause damage. Very little actual harm resulted.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments Vacant.

GAS ENGINEER AND MANAGER. Blackburn Corporation. Applications by Feb. 25.
ENGINEER-REPRESENTATIVE (Telpherage, &c.). J. W. Broadhead (Robert Dempster and Sons), Elland.
ASSISTANT TO MANAGER. Horley Gas Company.
JUNIOR CHEMIST. Barrow-in-Furness Corporation. Applications by Feb. 13.
DISTRICT INSPECTOR. Aldershot Gas, Water, and District Lighting Company.
BRICKLAYER AND RETORT SETTER. Gravesend Gas-Works.
TIME AND WAGES CLERK. No. 5991.
FOREMAN. No. 5985.
LEAD BURNER (for India). Koppers Company, 31, Glossop Road, Sheffield.

Appointments Wanted.

MANAGER OR ASSISTANT. No. 5989.
WATER GAS MAKER. No. 5990.

Gas-Works Wanted.

Particulars to "PRINCIPAL," Scripps's Advertising Offices, 13, South Molton Street.

Plant, &c. (Second-Hand), for Sale.

EXHAUSTER. Wrexham Gas Company.

Sales of Stocks and Shares.

BRENTWOOD GAS COMPANY. London Mart. Feb. 23.
FALMOUTH WATER COMPANY. London Mart. Feb 23.
HERTS AND ESSEX WATER COMPANY. London Mart. Feb. 23.
SOUTHEND WATER COMPANY. London Mart. Feb. 23.

Meetings.

BARNET GAS AND WATER COMPANY. Holborn Restaurant. Feb. 25. 12 30 o'clock.
BRENTFORD GAS COMPANY. St. Ermin's Hotel, Westminster. Feb. 12. 2.30 o'clock.
BRIGHTON AND HOVE GAS COMPANY. 5, Great Winchester Street, E.C. Feb. 19. Two o'clock.
CHICHESTER GAS COMPANY. Gas-Works. Feb. 23. One o'clock.
NORTH MIDDLESEX GAS COMPANY. 5, Great Winchester Street, E.C. Feb. 22. 2.30 o'clock.
RIDDINGS DISTRICT GAS COMPANY. 130, Cannon Street. Feb 24. 2.30 o'clock.
SOUTHGATE AND DISTRICT GAS COMPANY. 5, Great Winchester Street, E.C. Feb. 25. 3.45 o'clock.

TENDERS FOR

Carbonizing Plant (Complete).

WOMBWELL GAS DEPARTMENT. Tenders by Feb. 22.

Cookers.

PLYMOUTH GAS DEPARTMENT. Tenders by Feb. 20.

General Stores (Tools, Sulphuric Acid, Lead, Lead Pipe, Cocks, Brass and Copper Goods, Oils, Paints, &c., Steel and Iron, Bolts, Asbestos Goods, &c.).

PLYMOUTH GAS DEPARTMENT. Tenders by Feb. 20.
WIGAN GAS DEPARTMENT. Tenders by Feb. 12.

Lighting Goods (Mantles, Glassware, Burners, Pendants, &c.).

DUBLIN CORPORATION. Tenders by Feb. 18.
PLYMOUTH GAS DEPARTMENT. Tenders by Feb. 20.

Meters.

PLYMOUTH GAS DEPARTMENT. Tenders by Feb. 20.

Pipes, &c.

PLYMOUTH GAS DEPARTMENT. Tenders by Feb. 20.
WIGAN GAS DEPARTMENT. Tenders by Feb. 12.

Tar.

LITTLEHAMPTON GAS COMPANY. Tenders by Feb. 24.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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Resists 4500° Fahr. Best for GAS-WORKS.
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SPENCER'S PATENT HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Dec. 15, p. 634.

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MANUFACTURERS OF
GAS METERS (Ordinary and Prepayment), "FALCON" INVERTED LAMPS and SQUARE LANTERNS for Street Lighting, INVERTED BURNERS and CONVERSION SETS for Street Lamps.

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MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 & 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

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JOHN RILEY & SONS, Limited, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 years. References given to Gas Companies.

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WANTED—Gentleman to Represent the Telpherage and Conveying Department of Robert Dempster and Sons, Limited, Engineers, Elland. Must have good Electrical Knowledge, and be Conversant with the Subject. None but First-Class Engineers need apply.

State Age, Salary required, and Experience, to Mr. J. W. BROADHEAD, care of Robert Dempster and Sons, Limited, Rosemount Iron-Works, ELLAND.

COUNTY BOROUGH OF BLACKBURN.

APPOINTMENT OF GAS ENGINEER AND MANAGER.

THE Corporation of Blackburn invite APPLICATIONS for the Position of GAS ENGINEER AND MANAGER.

The Salary will be £800 per Annum.

Candidates must not exceed the age of 45 Years.

The Gentleman appointed will be required to Devote the Whole of his Time to his Duties and will not be allowed to engage in Private Practice.

Canvassing, either directly or indirectly, will be regarded as a Disqualification.

Original Testimonials must not be sent, and if sent will not be returned.

Applications, Stating Age, Qualifications, and Experience, accompanied by *copies* of not more than three recent Testimonials and endorsed "Gas Engineer," to be sent to the undersigned not later than Twelve o'clock at noon on Thursday, the 25th inst.

By order,

LEWIS BEARD, Town Clerk.

Town Hall, Blackburn, Feb. 8, 1915.

GAS-WORKS FOREMAN.

WANTED—Steady, Experienced Car- BONIZER for 900 Million works, South Coast Town, having thorough knowledge of Regenerative and Direct-Fired Settings, Electrically driven Stoking Machinery, Coal and Coke Handling Plants.

Applications, by letter, stating Age, Wages required, and Particulars of Experience, with *copies* of Three recent Testimonials, to No. 5985, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

BARROW-IN-FURNESS CORPORATION.

(GAS AND WATER WORKS.)

JUNIOR Chemist wanted, with Good General Experience of Routine Work of Medium-Sized Gas-Works.

Applications, stating Age, Experience, and Salary required, and accompanied by *copies* of Two recent Testimonials, to be addressed to the undersigned not later than Saturday, the 13th of February, and endorsed "Junior Chemist."

By order,

L. HEWLETT, Town Clerk.

Town Hall, Barrow-in-Furness.

WANTED—District Inspector to act as DEPUTY for one of our important Groups of Districts. Must be a Qualified man, in Gas and Water Distribution and Fittings. Commencing Wages would be 42s. 6d. per week, without Residence.

Application, in own handwriting, accompanied by *copies* of Three recent Testimonials, addressed to the GENERAL MANAGER, Aldershot Gas, Water, and District Lighting Company, Victoria Road, ALDERSHOT.

EXPERIENCED Lead Burner Wanted for India, to carry out work in connection with Sulphate Plants for Coke Ovens on the Direct System. Must have previous Experience and be able to work independently.

Apply, giving full Particulars of Experience, Wages required, &c., to KOPPERS' COMPANY, 301, Glossop Road, SHEFFIELD.

GRAVESEND AND MILTON GAS LIGHT COMPANY.

GENERAL Bricklayer and Retort SETTER required. Permanent situation to Steady Man. Must be well acquainted with Regenerative Settings.

Apply, stating Wages required, to the ENGINEER, Gas-Works, GRAVESEND.

WANTED, during the War, a Time and WAGES CLERK.

Apply, by letter, stating Experience and Wage required, to No. 5991, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C.

HORLEY DISTRICT GAS COMPANY.

WANTED—A Youth to Take Charge of Works Office and act as ASSISTANT to MANAGER.

Apply to R. SEYMOUR TOBEY, Gas-Works, HORLEY, Surrey.

ADVERTISER is prepared to Pay a Commission to anyone Introducing a SMALL GAS-WORKS that can be PURCHASED for Cash, where there is Scope for Development.

Particulars in Confidence, or write for interview to "PRINCIPAL," Scripps's Advertising Offices, 13, SOUTH MOLTON STREET, W.

WREXHAM GAS COMPANY.

GAS-Exhauster for Sale.—One Two- Blade Steam Driven GAS-EXHAUSTER, by the Bryan Donkin Company. Capacity, 20,000 Cubic Feet per Hour; being replaced by one of larger size. Can be seen working during the next few weeks.

Apply to the MANAGER, Gas-Works, WREXHAM.

COUNTY BOROUGH OF WIGAN.

(GAS DEPARTMENT.)

THE Gas Committee invite TENDERS for the Supply of STORES over the Year ending on March 31, 1916, as follows:—

(*a*) WROUGHT-IRON TUBES AND FITTINGS.
(*b*) BRASS AND COPPER TUBES AND FITTINGS.
(*c*) LEAD GAS-PIPE.
(*n*) CAST MAINS AND CONNECTIONS.
(*q*) SULPHURIC ACID.

Forms of Tender may be obtained from the undersigned.

The Committee do not bind themselves to the acceptance of any Tender.

Tenders, sealed and endorsed with the name of the Article Tendered for, to be Delivered to Wm. Hy. Tyrer, Esq., Town Clerk, Wigan, on or before the 12th inst.

A Sample of each Article to be forwarded addressed to the Gas Engineer.

FRED. BETLEY, Engineer, &c.

Borough Gas-Works, Feb. 3, 1915.

WOMBWELL URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

NEW CARBONIZING PLANT.

THE Wombwell Urban District Council invite TENDERS from responsible Contractors for the Erection at the Gas-Works, Wombwell, of a COMPLETE CARBONIZING PLANT having a capacity of 650,000 Cubic Feet per diem.

The Site may be inspected and full Particulars, Specification, and a Block Plan of the Site may be had on Application to the Engineer (Mr. P. D. Walmsley), at the Gas-Works Offices.

Sealed Tenders, endorsed "Carbonizing Plant," accompanied by Drawings and a complete Specification of the whole Plant, must be Delivered to me not later than Monday, the 22nd day of February, 1915.

The acceptance of any Tender by the Council will be subject to the Council obtaining the sanction of the Local Government Board to the borrowing of the amount required.

PERCY MILNES WALKER, Solicitor, Clerk.

Town Hall, Wombwell.

COUNTY BOROUGH OF PLYMOUTH.

(GAS DEPARTMENT.)

TENDERS are invited for the Supply of:—

1.—COOKERS, &c.
2.—Ordinary and Prepayment METERS.
3.—COMPO. PIPE, LEAD PIPE, and PIG LEAD.
4.—MAIN COCKS and BRASS GOODS.
5.—PENDANTS, BRACKETS, and SUNDRIES for AUTOMATIC INSTALLATIONS.
6.—WROUGHT-IRON TUBES and FITTINGS.
7.—PAINTS, OILS, TALLOW, WASTE, &c.
8.—MANTLES, PROTECTORS, &c.
9.—SUNDRIES (STEEL and IRON, BOLTS and NUTS, ASBESTOS GOODS, TOOLS, &c.).

Specification and Form of Tender may be obtained from the undersigned.

Sealed Tenders, endorsed "Tender for ——," addressed to the undersigned, must be Delivered before Twelve noon on the 20th of February, 1915.

The Corporation do not bind themselves to accept the lowest or any Tender.

W. P. TERVET, Engineer and Manager.

Gas-Works, Devonport.

CORPORATION OF DUBLIN.

TENDERS FOR REQUIREMENTS FOR THE PUBLIC LIGHTING DEPARTMENT.

THE Corporation of Dublin are pre- pared to receive TENDERS for the Supply of Requirements for their Public Lighting Department —viz., MANTLES, JENA CHIMNEYS, BURNERS WROUGHT-IRON BRACKETS, DRAUGHT SCREENS, &c., for a period of Twelve Months from the 1st of April, 1915.

Specifications, with Terms and Conditions and Forms of Tender, may be obtained from the City Engineer, 28, Castle Street, Dublin, on payment of the sum of One Shilling for each Form, and any Inquiries relative to Quantities, &c., should be addressed to the Inspector of Lighting, Tara Street, Dublin.

Samples of at least six of each of the Mantles and Chimneys to be forwarded to the Town Clerk, City Hall, Dublin.

The Tenders to be enclosed in a Sealed Envelope, marked "Tenders for Requirements for the Public Lighting Department," addressed to the Chairman of the Supplies Committee, City Hall, Dublin, and forwarded on or before the 18th day of February, 1915.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,

HENRY CAMPBELL, Town Clerk.

Town Clerk's Office, City Hall, Dublin, Feb. 4, 1915.